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TRANSCRIPT OF RECORD.

SUPREME COURT OF THE UNITED STATES.

No. 326. 67

THE GOODYEAR DENTAL VULCANITE COMPANY, APPELLANT,

vs.

CHARLES G. DAVIS.

APPEAL FROM THE CIRCUIT COURT OF THE UNITED STATES FOR THE DISTRICT OF MASSACHUSETTS.

FILED OCTOBER 22, 1877.

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a TRANSCRIPT OF RECORD.

VOL. I.

Pleadings and evidence for complainants.

THE GOODYEAR DENTAL VULCANITE COMPANY, complainants,
v.
CHARLES G. DAVIS, DEFENDANT.

Circuit court of the United States, district of Massachusetts. In equity.

1 UNITED STATES OF AMERICA,
Massachusetts District, ss :

At a circuit court of the United States for the first circuit, begun and holden at Boston, within and for the district of Massachusetts, on Tuesday, the fifteenth day of May, in the year of our Lord one thousand eight hundred and seventy-seven.

Before the honorable George F. Shepley, circuit judge.

THE GOODYEAR DENTAL VULCANITE COMPANY, a corporation established by law
1a of the State of New York, complainants,
v.
CHARLES G. DAVIS, OF NEW BEDFORD AND county of Bristol, dentist, and a citizen of the State of Massachusetts, defendant.
} In equity.

The bill of complaint in this cause was filed in the clerk's office on the first day of April, A. D. 1876, and was duly entered at the October term of this court, A. D. 1875, and is in the words and figures following, namely :

1b *Bill of complaint.*

To the honorable the judges of the circuit court of the United States for the first circuit, within and for the district of Massachusetts, sitting in equity.

The Goodyear Dental Vulcanite Company, a corporation established by law of the State of New York, bring this bill against Charles G. Davis, of New Bedford and county of Bristol, dentist, and a citizen of the State of Massachusetts.

And thereupon your orators complain and say, that heretofore, to wit, before the seventh day of June, in the year eighteen hundred and sixty-four, one John A. Cummings, who was then a citizen of the United States, being the original and first inventor of a certain new and useful improvement in artificial gums and palates, not at that time in public use, nor on sale with his consent or allowance for more than two years, made application in due form of law to the Government of the United States for its letters patent for such improvement; upon which application such proceedings were had that, on the said seventh day of June, letters patent of the United States, dated the said seventh day of June, signed

by the Secretary of the Interior, and countersigned and sealed
2 with the seal of the Patent Office, by the Commissioner of Patents, were issued and delivered to the said Cummings, for the said invention, entitled an "Improvement in artificial gums and palates," whereby there was granted to the said Cummings, his heirs, administrators, or assigns, for the term of seventeen years from the said date thereof, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, as in and by a certified copy of the said letters patent ready to be produced, as this court may direct, will more fully appear.

And your orators further show unto your honors, that afterward, to wit, on the thirtieth day of July, A. D. 1864, by certain deeds of assignment duly executed and recorded in the United States Patent Office, all right, title, and interest in the said letters patent, and the invention and improvement secured thereby, became vested in the Dental Vulcanite Company, a corporation established by law of Massachusetts, as by the said deeds of assignment, or certified copies thereof, with the endorsements of the recording thereon, ready to be produced, as this court may direct, will more fully appear.

And your orators further show unto your honors that the said Dental Vulcanite Company, after such assignment to them, surrendered their aforesaid patent, according to law, on account of a defective specification; and a new patent was duly issued to them on the tenth day of January, 1865, for the same invention, in accordance with their corrected description and specification, whereby was granted and secured to the said Dental Vulcanite Company and their successors and assigns, for the full term of seventeen years from the said seventh day of June, 1864, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvements therein described and claimed, as in and by said reissued letters patent, or a certified copy, ready to be produced, as this court may direct, will more fully appear.

And your orators further show unto your honors that afterward, to wit, on the twenty-first day of March, 1865, these last named letters patent were, according to law, surrendered by the said Dental Vulcanite Company, and cancelled on account of defects still discovered in the specification, and a new patent was duly issued bearing said last named date, in accordance with their corrected description and specification, and for the same improvements, whereby was granted and secured to
the said Dental Vulcanite Company and their successors and as
3 signs, for the full term of seventeen years from the said seventh day of June, 1864, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvements therein specified and claimed, as in and by said second reissued letters patent, No. 1904, or a certified copy thereof, ready to be produced, as this court may direct, will more fully appear.

And your orators further show, that on the seventeenth day of July, A. D. 1866, the said Dental Vulcanite Company, by a certain deed of assignment of that date, did sell and assign to one Josiah Bacon, of Boston, Massachusetts, the said letters patent and all the rights thereby vested, together with the right to sue for and collect to his own use all damages for past infringements thereon, as by said deed of assignment, or a certified copy thereof, with the endorsements of the recording thereon, ready to be produced as this court may direct, will more fully appear; and that said assignment was made in trust for certain persons then associated together with intent to form the corporation which is

your orator in this bill, and in contemplation of the formation of such corporation, and that such associates did afterwards form and are now members of such corporation.

And your orators further show unto your honors, that the said Bacon, on or about the seventh day of January, 1868, by his deed of that date, in pursuance of said trust assigned to your orators, the said Goodyear Dental Vulcanite Company, the said letters patent, and all rights and privileges under the same, and also the right to demand, sue for, and collect to their own use all damages at law and profits in equity for past infringements of said letters patent, as by said deed of assignment, or a certified copy thereof, with the endorsements of the recording thereon, ready to be produced as this court may direct, will more fully appear; but your orators, the said Goodyear Dental Vulcanite Company, submit that they are entitled in equity to recover such profits by reason of the said Bacon's holding of said patent having been in trust as aforesaid, as well as because they are assignees of all said Bacon's right to recover such profits.

And your orators further show unto your honors, that the said Cummings, his mesne assignees, and your orators have always, since the grant of the said letters patent, and during the time they each owned the same respectively, and in the exercise of the full and exclusive right and liberty so granted as aforesaid, made, used, and vended to others to be used, the said improvement so patented, and have had and
4 maintained, until the infringement hereafter complained of, exclusive possession of the said improvement and invention, under and by virtue of said letters patent, and have never acquiesced in any invasion or infringement of their said rights.

And your orators further show unto your honors, that since the date of the said letters patent, more than six thousand five hundred dentists, within the limits of the United States, have submitted to the claims of your orators and their assignors under said letters patent, and have taken licenses to use the said improvement under the same.

And your orators further show unto your honors, that the validity of said reissued letters patent, No. 1904, has been fully established by judicial decrees; that in the year 1864 a large number of dentists combined to resist said patent, under the name of the "United States Dental Protective Union," whereof one Isaac J. Wetherbee was president, and thereupon said Dental Vulcanite Company filed their bill of complaint against said Isaac J. Wetherbee, in the circuit court for the district of Massachusetts, praying for an injunction, and other relief in equity against said Wetherbee for infringement of said patent, to which bill of complaint the said Wetherbee filed his answer denying the validity of said letters patent, and alleging, among other defences, that said Cummings was not the original and first inventor thereof, and setting up, that many other persons, both in Europe and in the United States, used and practised said invention before said Cummings' alleged invention, and that the same had been previously described in a great number of patents and printed publications. Whereupon such proceedings were had, that evidence was taken by both parties upon all the points at issue, and the case was fully argued before the said circuit court before the honorable Judges Clifford and Lowell, by B. R. Curtis and Causten Browne, for complainants, and Geo. S. Boutwell and Joel Giles, for defendant, and thereupon, to wit, in June, 1866, said court rendered its decision upon all the points at issue, and ordered judgment and a final decree in favor of the complainants, and a perpetual injunction to be issued against said Wetherbee, enjoining him from infringing

upon said letters patent, as by a duly authenticated copy of said decree, ready to be produced, will more fully appear. That in the latter part of 1866, a large number of dentists combined together to resist said patent in the district of Maryland, and test cases were made on bills filed on November 23, 1866, in the United States circuit court for said
5 district, by Josiah Bacon v. Hugh Arthur and Robert Arthur, and by Josiah Bacon v. Adalbert Volck, and a full hearing was had on motions for interlocutory injunctions, on which the validity of said patent was fully and exhaustively argued by counsel for the respective parties, and on the 10th day of December, 1866, the court, Giles, J., rendered an opinion in favor of complainant, and decided to grant the injunctions. And thereupon such proceedings were had that decrees were made in favor of complainant in both of said suits, and said injunctions were made perpetual. That on the 14th day of April, 1868, a bill was filed in the United States circuit court for the western district of Pennsylvania, by the complainants in this cause against Charles Sill and Milton E. Gillespie, for infringement of said letters patent; and after full argument by counsel for the respective parties, on a motion for an interlocutory injunction in said suit, the said court, McCandless, J., rendered a decision in favor of complainants and granted the said injunction, on the 18th day of May, 1868. And thereupon such proceedings were had that on the 13th day of November, 1868, a decree in favor of the complainants was made in said suit, and said injunction was made perpetual.

That on the 16th day of September, 1868, a like bill was filed in the suit of Goodyear Dental Vulcanite Company v. Benoni E. Gardner, in the United States circuit court for the district of Rhode Island, and thereupon an interlocutory injunction was granted by the Hon. Justices Clifford and Bullock, after full argument by counsel for the respective parties, B. R. Curtis and Causten Browne, Esqs., for the complainants, and S. D. Law, J. A. Foster, B. F. Thurston, and Wingate Hayes, for the respondent, restraining said Gardner from infringing said patent by the manufacture and sale of sets of artificial teeth imbedded in elastic bases moulded to fit the mouth, composed of a new substance then recently invented and patented called "iodite," and thereafter a final decree for complainants was made in said cause.

That on the 14th day of June, 1873, a bill in equity was filed in the United States circuit court, for the district of Massachusetts, by the complainants in this cause, against one Daniel H. Smith, for infringement of said letters patent; and, thereupon, said Smith filed his answer, denying the validity of said letters patent, and alleging, among other defences, that many other persons therein named had used and practised said invention before said Cummings' alleged invention,
6 and that the same had been previously described in a great number of patents and printed publications. Whereupon evidence at great length was fully and exhaustively taken by both parties upon all the points at issue, and the said cause was fully argued before said court before the Hon. Geo. F. Shepley, circuit judge, on the 14th, 15th, and 16th days of January, 1874, by E. N. Dickerson and B. F. Lee, of New York, for complainants, and Henry Baldwin, jr., and Jeremiah S. Black, of Pennsylvania, for defendant; and, thereupon, on the 8th day of May, 1874, said court rendered its decision upon all the points at issue, and ordered judgment and a final decree in favor of the complainants.

That on the 27th day of July, 1872, a bill in equity was filed in the United States circuit court for the northern district of New York, by the complainants in this cause, against one Albert E. Root, for infringe-

ment of said letters patent, and said Root thereupon filed his answer, denying the validity of said letters patent, and alleging, among other defences, that many other persons therein named, had used and practised said invention before said Cummings' alleged invention, and that the same had been previously described in a number of patents and printed publications. Whereupon evidence at great length was fully and exhaustively taken by both parties upon all the points at issue, and the said cause was argued before said court, before the Hon. Ward Hunt, associate justice of the Supreme Court of the United States, by E. N. Dickerson and B. F. Lee, of New York, for complainants, and William H. Bright, of Utica, for defendant, and thereupon, on the 21st day of July, 1874, said court ordered a decree in favor of complainants.

That on the first day of May, 1873, bills in equity were filed in the United States circuit court, for the district of New Jersey, by the complainants in this cause, against Charles S. Stockton and Frank A. Cumminggs, for infringement of said letters patent; and, thereupon, said Stockton and Cummings filed their answers, denying the validity of said letters patent, and alleging, among other defences, that many other persons therein named had used and practised said invention before said Cummings' alleged invention, and that the same had been previously described in a great number of patents and printed publications. Whereupon evidence at great length was fully and exhaustively taken by both parties upon all the points at issue, and the said causes were fully argued before said court, before the Hon. John T. Nixon, judge, on the 13th day of July, 1874, by E. N. Dickerson and B. F. Lee, for complain-
7 ants, and Henry Baldwin, jr., and Jeremiah S. Black, for defendants, and, thereupon, on the 22d day of September, 1874, said court rendered its decision, and ordered decrees in favor of the complainants in both cases.

That on the tenth day of June, 1873, a bill in equity was filed in the United States circuit court for the eastern district of Michigan, by the complainants in this cause against one George Willis, for infringement of said letters-patent, and said Willis thereupon filed his answer, denying the validity of said letters patent, and alleging, among other defences, that many other persons therein named, had used and practised said invention before said Cummings' alleged invention, and that the same had been previously described in a number of patents and printed publications. Whereupon, evidence at great length was fully and exhaustively taken by both parties upon all the points at issue, and said cause was argued before said circuit court, before the Hon. Judges Emmons, Longyear, and Withey, by B. F. Lee, of New York, and Wm. Ashley, of Michigan, for complainants, and John F. Follett, of Ohio, and C. C. Burt, of Michigan, for defendant, and thereupon, on the 7th day of November, 1874, said court ordered a decree in favor of complainants.

That in a suit brought by the complainants in this cause against one Vincent D. Jackson, in the circuit court of the United States for the district of Indiana, the parties being in attendance by their respective counsel, at an accounting before the master, held on the first day of December, 1875, the question arose whether the account should embrace sets of artificial teeth made as described in said patent, substituting, however, in place of the elastic substance vulcanite, the elastic substance, collodion, known by the trade name of "celluloid"; and thereupon, testimony was taken on the point at issue, and thereafter, and on the fourth day of February, 1876, the said master filed his report, finding that said sets of teeth, so constructed on a "celluloid" base, were infringements of said patent, and awarding damages against the de-

fendant for the manufacture of the same. And thereafter, and on the sixth day of March, 1876, a final decree was made by said court in said cause, confirming said report, and ordering a perpetual injunction against the defendant, restraining said infringement, as by a duly authenticated copy of said decree, and of the master's report referred to therein, ready to be produced as this court may direct, will more fully and at large appear.

That in a suit brought by the complainants in this cause against one Jared Kibbee, in the circuit court of the United States for the
8 eastern district of Michigan, at an accounting before the master, held on the 10th day of December, 1875, the like question arose, whether the account should embrace sets of artificial teeth made as described in said patent, substituting however, in place of the elastic substance vulcanite, the elastic substance collodion, known by the trade name of "celluloid"; and thereupon a great mass of testimony was adduced by the respective parties on the point at issue, and thereafter and on the 22d day of December, 1875, the said master filed his report, finding that said sets of teeth, so constructed on a "celluloid" base, were infringements of said patent, and awarding damages against the defendant for the manufacture of the same. And thereafter and on the 12th day of February, 1876, a final decree was made by said court in said cause, confirming said report, and ordering a perpetual injunction against the defendant, restraining said infringement, as by a duly authenticated copy of said decree, ready to be produced as this court may direct, will more fully and at large appear.

That in a suit brought by the complainants in this cause against one James Silliman, in the circuit court of the United States for the district of New Jersey, at an accounting before the master, the like question arose, whether the account should embrace sets of artificial teeth made as described in said patent, substituting however, in place of the elastic substance vulcanite, the elastic substance collodion, known by the trade name of "celluloid"; and thereupon testimony at great length was adduced on the point at issue, and on the 30th day of December, 1875, the said master filed his report, finding that said sets of teeth so constructed on a "celluloid" base were infringements of said patent, and awarding damages against the defendant for the manufacture of the same. And thereafter, and on the 24th day of February, 1876, a final decree was made by said court in said cause, confirming said report, and ordering a perpetual injunction against the defendant restraining said infringement, as by a duly authenticated copy of said decree, ready to be produced as this court may direct, will more fully and at large appear.

That like proceedings were had in the month of December, 1875, in cases where the like question arose, before masters, in suits brought by the complainants in this cause against William H. Hoopes, in the circuit court of the United States for the district of Maryland, and against Emory J. Greene, in the circuit court of the United States for the western dis-
trict of Pennsylvania, and a great mass of testimony was adduced
9 upon the point at issue, by the counsel for the respective parties, in each of said suits, and thereafter the said masters reported that the making of such sets of teeth on the so-called "celluloid" base was an infringement of said patent, and awarded to complainants damages for the same, as by duly authenticated copies of said reports, to wit, the report in said case against Hoopes, filed on the 26th day of January, 1876, and the report in said case against Greene, filed on the 21st day of February, 1876, ready to be produced, as this court may direct, will more fully appear.

And your orators further show unto your honors, that they have obtained final decrees for profits and damages and perpetual injunctions in a great number of other suits.

And your orators further show unto your honors that the respondent herein, having full knowledge of the premises, and in violation of your orators' exclusive right and privilege as aforesaid, and utterly disregarding the same, has since the 17th day of July, 1866, and before and since the said assignment of the said letters patent to your orators, the Goodyear Dental Vulcanite Company, without the license of your orators, at New Bedford, Mass., and at various other places in the United States, manufactured, used, and sold, and still continues to manufacture, use, and sell, many sets of artificial teeth, embracing the improvement and invention described in said reissued letters-patent, and so secured to your orators—how many, your orators are unable to say, but pray that the respondent may discover and set forth in his answer to this bill.

And your orators further state, and charge the fact to be, that the said defendant has, as aforesaid, infringed upon said letters patent by the making of sets of artificial teeth imbedded in elastic bases moulded to fit the mouth, said bases being composed sometimes of the elastic substance known as vulcanite, and sometimes of the elastic substance solid collodion, known by the trade names of "rose pearl" and "celluloid"; all of the said sets of artificial teeth being substantially the articles of manufacture described and claimed in said reissued letters-patent, No. 1904.

And your orators further charge, on information and belief, that the defendant has used and practiced said invention without the license of your orators in each calendar year since the 31st day of December, 1873.

And your orators further show unto your honors that they will be subject to great and irreparable injury, unless they shall obtain from your honors the relief hereby sought.

10 To the end, therefore, that the said defendant may, if he can, show why your orators should not have the relief hereby prayed, and may upon his corporal oath and according to the best and utmost of his knowledge, remembrance, and belief, full, true, direct, and perfect answer make to all and singular the matters hereinbefore stated and charged, as fully and particularly as if the same were hereinafter repeated, and he thereunto distinctly interrogated, and more especially that he may answer and set forth—

1. Whether he has not made, or caused to be made, or used, or sold, the plate of hard rubber or vulcanite, or its equivalent for holding artificial teeth or teeth and gums, substantially as described in said reissued letters-patent, No. 1904, since the 17th day of July, 1866, and what number of such sets of artificial teeth, according to the best of his knowledge, information, and belief, as near as he can approximate the same?

2. Whether he has not made or caused to be made, or used, or sold, the plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth and gums, substantially as described in said reissued letters patent, No. 1904, since the first day of January last, and what number of such sets of artificial teeth, according to the best of his knowledge, information, and belief, as near as he can approximate the same?

3. Whether he has not made, or caused to be made, or used, or sold, the plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth or teeth and gums, substantially as described in said reissued letters patent, No. 1904, since the 17th day of July, 1866, in each of the successive years, ending on the 31st days of December thereof respectively, specifying separately each of the said years in which any of such

sets of artificial teeth were so made, used, or sold, and what number thereof in each of said years respectively, according to the best of his knowledge, information, and belief, as near as he can approximate the same?

4. Whether he has not received money or property, directly or indirectly, from the manufacture, use, or sale since the 17th day of July, 1866, of the plate of hard rubber, or vulcanite, or its equivalent, for holding artificial teeth or teeth and gums, substantially as described in said reissued letters patent, No. 1904, and what amount of such money or property he has received, or is entitled to receive from the man-
11 ufacture, use, or sale of such sets of artificial teeth, since the 17th day of July, 1866, specifying the amount received in each of the successive years ending on the 31st day of December thereof respectively, and also the amount received since the first day of January last, according to the best of his knowledge, information, and belief, as near as he can approximate the same?

And that the said respondent may answer the premises, and be decreed to account for and pay over to your orators all such gains and profits as have accrued to him from his said infringement by making, using, and selling such sets of artificial teeth, and also to pay to your orators, in addition to said profits, the damages which have been sustained by your orators by reason of said infringement, and that he may be restrained by an injunction issuing out of this honorable court from making, using, or vending to others to be used, any sets of artificial teeth, embracing the improvement so secured to your orators as aforesaid, and also that an injunction issue so restraining the defendant pending this cause, and for such other and further relief as the nature of the case may require, and to your honors may seem meet.

May it please your honors to grant unto your orators not only a writ of injunction conformable to the prayer of this bill, but also the writ of subpœna directed to said Charles G. Davis commanding him to appear and answer to this bill of complaint, and to do and receive what to your honors shall seem meet.

And your orators will ever pray.

GOODYEAR DENTAL VULCANITE COMPANY,
By its treasuer, JOSIAH BACON.

BROWNE & HOLMES,
Complainants' Solicitors.

11*a* UNITED STATES OF AMERICA,
District of Massachusetts, ss:

At Boston, in the county of Suffolk, in said district, this twenty first day of March, A. D. 1876. personally appeared Josiah Bacon, who signs the foregoing bill, and made oath that he is treasurer of the complainants, that he has read the said bill, and understands the same and the contents thereof; and that all the matters therein stated as of the knowledge of the complainants, are to his knowledge true, and as to all other matters therein stated, he verily believes them to be true.

Before me.

[SEAL.] JOHN G. STETSON,
U. S. Commissioner.

12 This cause was thence continued to the May term of this court, A. D. 1876, when, to wit, on the twenty-first day of July, A. D. 1876, the following answer was filed, namely:

Answer.

The answer of Charles G. Davis, defendant, to the bill of complaint of the Goodyear Dental Vulcanite Company, complainant.

This defendant, now and at all times hereafter saving and reserving to himself all and all manner of benefit or advantage of exception or otherwise, which can or may be had or taken to the manifold errors, uncertainties, imperfections, and insufficiencies in the said bill of complaint contained, for answer to said bill, or to so much and such parts thereof as this defendant is advised it is material or necessary for him to make answer unto, answering, saith:

This defendant is informed and believes, and thereupon admits that before the seventh day of June, in the year one thousand eight hundred and sixty-four, to wit, on or about the twenty fifth day of March, in said year one thousand eight hundred and sixty-four, one John A. Cummings, who was then a citizen of the United States, made application to the Government of the United States for its letters patent for a certain alleged improvement in artificial gums and palates, upon which application such proceedings were had that on the seventh day of June, in said year one thousand eight hundred and sixty four, letters
12*a* patent of the United States, numbered forty-three thousand and nine (43,009), dated the said seventh day of June, signed by the Secretary of the Interior and countersigned by the Commissioner of Patents, and sealed with the seal of the Patent Office, were issued and delivered to the said Cummings for the said alleged improvement.

But this defendant, upon information and belief, denies that said Cummings was the original and first inventor of said alleged improvement; he denies that said alleged invention was not at the time of said Cummings' application for said letters patent in public use and on sale; he denies that it had not been at that time in public use or on sale with his consent or allowance more than two years; and he denies that said Cummings or his assigns have any right to the exclusive use of said alleged improvement.

And this defendand further says upon information and belief that prior to the said seventh day of June, in the year one thousand eight hundred and sixty-four, the said Cummings had by an instrument of writing, under seal, duly executed and delivered, and dated on or about the first day of March, in said year one thousand eight hundred and sixty-four, assigned, sold, set over, and conveyed unto G. H. P. Flagg and H. D. Osgood, both of Boston, Massachusetts, and undivided quarter of all his right and interest in said alleged invention, and in the said letters patent issued upon the application therefor as aforesaid, as recourse being had to said instrument of writing as recorded in the United States Patent Office will more fully and at large appear, and as will fully appear recourse being had to a duly authenticated copy of said instrument ready in court to be produced. And this defendant further says upon information and belief that prior to the said seventh day of June, in the year one thousand eight hundred and sixty-four, the said Cummings had by an instrument of writing under seal, duly executed and delivered, and dated on or about the sixteenth day of May, in said year one thousand eight hundred and sixty-four, assigned, sold, set over, and conveyed to Josegh Gavett, of Boston, Massachusetts, one undivided eighth part of all his right or property in said alleged invention, and in the said letters patent thereafter issued upon the aforesaid
12*b* application therefor, as will fully appear, recourse being had to

said instrument of writing as recorded in the United States Patent-Office, or to a duly authenticated copy thereof ready in court to be produced.

And further answering, this defendant is informed and believes, and thereupon admits, that the aforesaid letters patent numbered forty-three thousand and nine (43,009) were, on or about the twenty-first day of December, in said year one thousand eight hundred and sixty-four, surrendered and canceled, and a new patent numbered (reissue) one thousand eight hundred and forty eight (1848) issued on the 10th day of January, in the year one thousand eight hundred and sixty-five, to the Dental Vulcanite Company in said bill mentioned; but this defendant, upon information and belief, denies all and singular the other allegations in said bill contained, respecting the surrender of said original letters patent and the reissue thereof, under date of January tenth, A. D. 1865.

And further answering, this defendant is informed and believes, and thereupon admits, that after said tenth day of January, in the year one thousand eight hundred and sixty-five, to wit, on or about the twenty-seventh day of February, in the year one thousand eight hundred and sixty-five, the aforesaid reissued letters patent, numbered one thousand eight hundred and forty-eight, were surrendered and canceled, and he so as aforesaid admits that a new patent was thereupon issued to the said Dental Vulcanite Company in accordance with their corrected description and specification, such second reissue bearing date the twenty-first day of March, in said year one thousand eight hundred and sixty-five, and being numbered (reissue) one thousand nine hundred and four; but he so as aforesaid denies that said last mentioned reissue was for the same alleged improvement which was described and claimed in said original letters patent No. 43,009, issued to said Cummings, under date of June 7, 1864, as aforesaid, and he further denies that thereby was secured to said, Dental Vulcanite Company, their successors and assigns, the exclusive right and liberty of making, constructing, using, and vending to others to be used, the alleged improvement therein specified and claimed, as in said bill of complaint alleged.

12c And further answering, this defendant says that he is informed and believes, and thereupon admits, that Josiah Bacon, in said bill mentioned, did, on or about the seventh day of January, 1868, by his deed of that date, assign to this complainant, the Goodyear Dental Vulcanite Company, the said letters patent and all rights and privileges under the same, as in said bill alleged.

And further answering, this defendant, upon information and belief, denies that the said Cummings, his mesne assignees, and this complainant have always, since the grant of said letters patent, and during the time they each owned the same respectively, and in the exercise of the alleged right and liberty so granted as aforesaid, made, used, and vended to others to be used, the said alleged improvement so patented as aforesaid; or have had and maintained, until the alleged infringement complained of in said bill, exclusive possession of said alleged improvement and invention under and by virtue of said letters patent; and he, so as aforesaid, further denies that they have never acquiesced in any invasion or infringement of their said alleged rights.

And further answering, upon information and belief, this defendant further admits that since the date of the said letters patent, more than five thousand dentists within the limits of the United States have submitted to the claims of this complainant and its assignors under said letters patent, and have taken licenses to use the said alleged improve-

ment, to wit, plates of hard rubber or vulcanite, under said letters patent.

And this defendant, further answering, denies that the validity of said reissued letters patent No. 1904 has been fully established by judicial decrees, although he is informed and believes, and thereupon admits, that on or about the twenty-fifth day of October, A. D. 1864, the said Dental Vulcanite Company filed their bill of complaint against one Isaac J. Wetherbee in the United States circuit court for the district of Massachusetts, praying for an injunction and other relief in equity against said Wetherbee for alleged infringement of said original letters patent numbered forty three thousand and nine, and dated June 7,

12*d* A. D. 1864, as aforesaid, by the manufacture and sale of plates of hard rubber or vulcanite for holding artificial teeth or teeth and gums; that the said Wetherbee filed his answer to said bill of complaint, denying the validity of said letters patent, and alleging, among other defences, that said Cummings was not the original and first inventor of the improvement patented to him in said original letters patent No. 43009, and setting up that many other persons, both in Europe and in the United States, used and practiced said improvement before said Cummings' alleged invention thereof.

And this defendant, further answering, upon information and belief, says that upon the filing of said answer to said bill by said Wetherbee, or very soon thereafter, the said letters patent were surrendered and canceled and reissued under date of January 10, 1865, and this reissue was again thereafter surrendered and canceled and reissued under date of March 21, A. D. 1865, as hereinbefore set forth. That after said several reissues of said letters patent, said cause was proceeded in between said Dental Vulcanite Company and said Wetherbee, but the pleadings therein on the part of said Wetherbee were in the final decision of said suit adjudged irregular, and under such adjudication many of the defences set up by said Wetherbee were excluded from consideration by said court; others of the defences set up by said Wetherbee were avoided by the reissue of said letters patent after said Wetherbee had filed his answer to said bill of complaint; others of said Wetherbee's defences in said suit were not supplemented by proof, but were waived or abandoned, the charge of infringement was adjudged to be admitted in legal contemplation, and the only points at issue on the final hearing of said cause did not involve the defences hereinafter made by this defendant, nor include the proofs upon which this defendant relies; and the decree alleged in the bill of complaint, as rendered in said suit, was not based upon correct conclusions of law or fact, and is therefore not in anywise conclusive as to the validity of the said reissued letters patent set out in the bill of complaint in this cause, nor as to the rights of the complainant alleged therein.

And further answering, this defendant says, that respecting the

12*e* alleged proceedings in the United States circuit court for the district of Maryland by Josiah Bacon against Hugh Arthur and Robert Arthur and against Adalbert Volck, and respecting the alleged proceedings in the United States circuit court for the western district of Pennsylvania against Sill and Gillespie, mentioned in said bill of complaint, this defendant has no knowledge or information other than is afforded by the said bill of complaint itself, save that he is informed and believes that all of said proceedings were taken and had under or in connection with the letters patent granted to Nelson Goodyear May 6, 1851, as reissued in 1858, and that the issue of infringement therein

was only as to the manufacture and sale of plates of hard rubber or vulcanite for holding artificial teeth, or teeth and gums; that said suits were not, nor was any or either of them, brought to final hearing, nor any proofs taken therein after the interlocutory injunctions were granted, as alleged in said bill of complaint; and he is further informed and believes that said suits were not contested suits, and did not raise any inquiry into the validity of the letters patent set out in the bill of complaint in this cause, and that said suits were compromised, or the defences thereof abandoned, in view of their connection with the aforesaid letters patent of Nelson Goodyear; and this defendant is advised and believes, and thereupon avers, that said proceedings are not in anywise conclusive as to the validity of the said reissued letters patent set out in the bill of complaint in this cause, nor as to the rights of the complainant alleged therein.

And further answering, this defendant says, in regard to the suit against Benoni E. Gardner, he is informed and believes, and thereupon avers, that this complainant and said Josiah Bacon did institute proceedings against said Gardner in the United States circuit court for the district of Rhode Island, and did take a decree and an injunction against him, and that thereupon an appeal was taken to the Supreme Court of the United States and there argued, and the decree of said circuit court affirmed; but this defendant is informed and believes, and thereupon avers, that said proceedings in said suit in the circuit court of Rhode Island, and in the said Supreme Court of the United States, were collusive, fraudulent
12*f* and false; that there was no dispute between said complainants and said Gardner in said circuit court, nor in said supreme court; that the decree in said circuit court was not, and was not intended to be enforced, but that before and at the date of such decree said Gardner was protected against the same by agreements made in that behalf between said complainants and one J. B. Newbrough; that the injunction awarded against said Gardner was not, and was not intended to be enforced; that the costs in said suit and on said appeal were paid by said complainants; that both sides of said cause were argued, at the fraudulent and collusive hearing thereof, before Mr. Justice Clifford, by counsel who were paid for such arguments by said complainants; that said complainants paid counsel on both sides for preparing the record in said cause and for arguing the same on the appeal before said Supreme Court, and that both in said circuit court and in said Supreme Court said complainants controlled the preparation and argument of the said cause so as to make the same collusive in both courts; that upon due proceedings had in that behalf these facts were laid before the said Supreme Court of the United States, at the adjourned term in October, 1872, and that in their answer, filed in the course of these proceedings, said complainants admitted that in said suit they had paid the counsel employed for the pretended defence, as well as for themselves, in the circuit court, and subsequently in said Supreme Court, and thereupon the said Supreme Court of the United States did, as this defendant is informed and believes, on or about the third day of March, A. D. 1873, annul and vacate its affirmance of said decree in Rhode Island, and dismissed the said false and collusive appeal, and recalled the mandate which had been issued to said circuit court, by reason of the said cause having been merely collusive both in the court below and in the said Supreme Court, so that said decrees are not in anywise conclusive as to the validity of the said reissued letters patent set out in the bill of complaint in this cause, nor as to the rights of this complainant alleged therein.

And this defendant, further answering, says, that in said suit
12*g* the court found on the question of infringement that said defendant, Gardner, used hard rubber or vulcanite, so that said suit did not raise the issues nor involve the defences made and relied upon in this cause by this defendant, and the said decree in said Gardner suit, besides being of no legal force or effect by reason of the aforesaid fraud and collusion in obtaining the same, was not, and is not in anywise, conclusive as to the validity of said reissued letters patent No. 1904, set out in the bill in this cause, nor as to the alleged rights of this complainant herein.

And this defendant, further answering, avers upon information and belief, that the substance called "iodite," as mentioned in said bill, is composed of caoutchouc or india-rubber and sulphur, with other ingredients, and is a vulcanizable compound of rubber and sulphur, and said vulcanizable compound is vulcanized or converted into hard rubber or vulcanite by being subjected to a high degree of heat, and he so as aforesaid further avers that said substance called "iodite" was and is one of the varieties of hard rubber or vulcanite, as Simpson's rubber is another variety, the production of which involves the Goodyear process, patented May 6, 1851, in letters patent of the United States No. 8075, to Nelson Goodyear, and more fully described in the reissues (Nos. 556 and 557) of that patent issued May 18, 1858, to Henry B. Goodyear, administrator of said Nelson Goodyear.

And this defendant, further answering, says, that he is informed and believes, and thereupon admits, that suit was brought against Daniel H. Smith in Massachusetts, and argued and decided in favor of this complainant; but he so as aforesaid further says, that in said suit the defendant admitted in his answer that he had made and sold plates made of hard rubber or vulcanite for holding artificial teeth, or teeth and gums, and there was consequently no question as to infringement in that suit; and he so as aforesaid further says, that said suit did not determine the points involved in this cause, nor were such points even collaterally under consideration therein, and that said suit is therefore not conclusive as to the questions arising in this cause. And he so as aforesaid further says that an appeal has been taken from said decision
12*h* in said Smith case, and is now depending and undetermined in the Supreme Court of the United States, where it will be argued at the coming term of said Supreme Court.

And this defendant, further answering, says that he is informed and believes, and thereupon admits, that suit was brought against Albert E Root in the northern district of New York, and decided in favor of this complainant; but he so as aforesaid further says that Mr. Justice Hunt decided said suit upon the authority of the cases of Wetherbee and of Smith, hereinbefore referred to, and that the alleged and admitted infringement was by making plates of hard rubber or vulcanite; wherefore said decision is not conclusive as to the questions arising in this cause.

And this defendant, further answering, says that he is informed and believes, and thereupon admits, that suits were brought in New Jersey against Charles Stockton and Frank A. Cummings; but he so as aforesaid further says, that these were but literal duplications of the pleadings and proofs in the Smith case, above mentioned, including the admission of infringement, as aforesaid; and he so as aforesaid denies that either of said cases was argued, but, on the contrary, avers that they were not argued, on either side, but were simply submitted to and passed upon by Judge Nixon, who adopted the decision in the Smith

case under the rule of comity, and without filing any opinion, merely gave decrees for this complainant upon the authority of Judge Shepley and of the above decision of Mr. Justice Hunt; wherefore, as aforesaid, said decrees are not conclusive upon the issues raised in this suit.

And this defendant so as aforesaid, further answering, further says that in the case against George Willis, in said bill mentioned, the pleadings and proofs were mere literal duplications of the record in said Smith case, and in said Stockton and Cummings cases, including the admission of infringement by the manufacture and sale of plates made of hard rubber or vulcanite for holding artificial teeth, or teeth and gums, and that Judge Emmons decided said case under the rule of comity, in conformity with Judge Shepley's decision in said Smith case, and with the adoption of that decision by Mr. Justice Hunt and Judge Nixon;

12*i* wherefore said decision is not conclusive as to the issues made in this case, which issues were not involved nor considered in said suit against said Willis.

And this defendant, further answering, says that as to the alleged suit in Indiana against Vincent D. Jackson, he has no knowledge or information save the statement in complainant's bill, and cannot say whether or not any such suit was brought, or if brought, whether it was brought under said reissue No. 1904; but he is advised and believes, and thereupon avers, that it appears by said bill that there was no defence whatever interposed, nor any appearance entered, nor any plea, answer, or demurrer filed in said cause by said alleged defendant, but that under a decree pro confesso the said defendant was summond before a master, who assumed the functions of the court, as to the question of infringement, and found certain alleged facts upon such question, to which finding there does not appear to have been any objections taken nor any exceptions filed or argued, nor does said bill allege any determination or consideration of such question by said court, nor does it appear that said court approved said alleged finding; whereupon, and for other reasons appearing upon the face of said bill, this defendant submits that said alleged suit, and said alleged proceedings in said alleged suit, are entitled to no weight or force in this cause; and this defendant, upon advice and belief, denies that any report was filed in said alleged suit, finding that sets of teeth constructed on a "celluloid" base were infringements of the reissued letters patent No. 1904, or that said court confirmed any such finding therein, and he so as aforesaid further denies that said court ordered any injunction restraining said alleged defendant from the construction of sets of teeth on bases of celluloid, or from the use of celluloid as a base for artificial teeth.

And this defendant, further answering, says that he is informed and believes, and upon information and belief avers, as to the suit in Michigan against Jared Kibbee, that the said Kibbee made no defence, and interposed no plea, answer, or demurrer to the bill of complaint, but that under a decree pro confesso he appeared before a master, who found and reported to said court as follows, to wit:

12*j* United States circuit court, eastern district of Michigan. In equity.

THE GOODYEAR DENTAL VULCANITE COMPANY and Josiah Bacon, complainants,
against
JARED KIBBEE, DEFENDANT.

In pursuance of a decretal order made in the above-entitled cause, on

the third day of November, in the year of our Lord one thousand eight hundred and seventy-five, by which it was referred to the undersigned to ascertain, take, and state, and report to the court an account of the gains and profits which the defendant has received, or which have arisen or accrued to him from infringing the exclusive rights of the complainants, by the manufacture, use, and sale of the improvements patented in the letters patent upon which this suit was brought, and also, in addition to said profits, to assess the damages which the complainants have sustained by reason of said infringement, and to report thereon to the court,

I, Addison Mandell, the master to whom the matter was referred, do report that I have been attended by the counsel for the complainants, and by said defendant, Jared Kibbee, in person, and have taken and examined the testimony offered on the part of complainants and defendant, and do find that no gains and profits have been proven to have been received by, or to have arisen or accrued to the defendant, from the manufacture, use, or sale of the improvements patented in the letters patent set forth and described in the order of reference in this cause, and that two hundred and twenty dollars ($220) damages have been proven to have been sustained by the complainants by reason of said infringement.

12*k* Said testimony is filed herewith, and marked Exhibit A and Exhibit D.

Schedule A, herewith filed, shows the items of the damages sustained by the complainants by reason of said infringement.

All of which is respectfully submitted.

Dated December 18, 1875.

ADDISON MANDELL,
Master, etc.

SCHEDULE A.

Damages for infringement prior to January 1, 1874	$100
" " " during the year 1874	60
" " " " " " 1875	60
	$220

ADDISON MANDELL,
Master, etc.

To which findings and report there was no objection taken, nor any exceptions filed or argued; and said decree, if affirmed at all, was affirmed by said court without knowledge of the alleged question or enquiry as to celluloid bases; whereupon, and upon other facts appearing upon the face of this complainants' bill in this cause, and for reasons apparent upon the face of the foregoing report of said master, this defendant submits that said suit, and said alleged proceedings therein, are not entitled to any force or weight in this cause.

And this defendant, further answering, says that he has no knowledge or information respecting the alleged suit against James Silliman in New Jersey, save such statements as are set forth in complainants' bill, but he is advised and believes, and therefore avers, that said alleged decree, if made in said cause, was made by the said court in ignorance of the alleged facts found by the master, and in the course of the ordinary ex parte proceedings under a decree pro confesso, without the presence of counsel for said alleged defendant, and without any

mention of the alleged infringement by the use of celluloid
127 either in the said master's alleged report or in the alleged decree; and for these reasons, as well as for other reasons appearing upon the face of said bill of complaint in this cause, this defendant is advised and believes, and thereupon submits, that said alleged proceedings in said suit against said Silliman are of no force or effect in this cause.

And this defendant, further answering, says he is informed and believes, and thereupon avers, that in respect to the suit against Wm. H. Hoopes, in Maryland, there was a decree pro confesso for want of an answer, and the usual reference to a master; that the only testimony adduced in said cause was stipulated into the case upon said reference, and was not before the court therein; that the question whether a set of teeth on a celluloid base was an infringement of said reissue 1904 was raised before said master, who found in the affirmative, and so reported to the court; that afterwards the said report of said master came up for confirmation, and the attention of the court, Hon. Wm. F. Giles, district judge, sitting therein, was called to the said finding as to celluloid plates, and that thereupon the court refused to confirm said report, and held that the master in said cause had exceeded his province in going into the question of infringement by the use of celluloid plates, and said report still remains unconfirmed; wherefore, and for other reasons appearing upon the face o said bill of complaint in this cause, this defendant is advised and believes, and thereupon submits, that said proceedings in said suit against said Hoopes are of no force or effect in this cause.

And this defendant, further answering, upon information and belief, further says, as to the suit against Emory J. Greene, in the western district of Pennsylvania, that the proceedings therein before the master were under a decree pro confesso, and the only testimony adduced in said cause was stipulated into the case before said master, and has never yet been before the said court; that said master found that said Greene had infringed said letters patent, reissue No. 1904, in the years 1873 and 1874, by making plates of hard rubber or vulcanite for holding artificial teeth, or teeth and gums, as described in said patent, and that
12*m* said master also found that the said defendant had infringed said letters patent by the use of celluloid in the manner described in the testimony adduced before him. And this defendant, so as aforesaid further answering, says that upon said report being filed in said court, exceptions thereto were filed on behalf of said defendant on or about the 30th day of May, 1876, of the following tenor, to wit:

United States circuit court, western district of Pennsylvania. In equity Nov. term, 1874.

THE GOODYEAR DENTAL VULCANITE COMPANY and JOSIAH BACON
vs.
EMORY J. GREENE. } No. 366.

Exceptions on behalf of the defendant to the report of H. D. Gamble, esq., master (dated February 21, 1876), under the decretal order of the court entered in said cause May 27, 1875.

This defendant, pursuant to the leave granted to that effect, now takes to this honorable court exceptions to the said report of said mas-

ter, as returned and filed in said cause, in the following particulars, to wit:

To the following finding of said report, to wit, that during "the year 1875 the defendant testifies that he used celluloid, but did not use hard rubber in making plates for artificial teeth.

"It appears from the evidence that the substance which the defendant uses is not vulcanized or hardened by the application of heat, but is rendered plastic by heat, and is then used substantially as described and claimed in complainants' letters patent. After carefully examin-
12*n* ing the said letters patent upon which this suit is brought, and the testimony of the experts in relation thereto, the master is of opinion that the nature or character of the substance used by defendant, being applied in substantially the same way, and for the same purpose as claimed in said letters patent of complainants, is the 'equivalent of hard rubber or vulcanite,' and hence is clearly within the claim of said letters patent, to wit, a 'plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth, or teeth and gums, substantially as described.'

"The master therefore concludes that the use of what is termed 'celluloid,' in the manner described in the testimony in this cause, is an infringement of the exclusive rights of complainants under their said letters patent."

Defendant excepts:

1st. Because the master erred in finding that celluloid is rendered plastic by heat, and is then used substantially as described and claimed in complainants' letters patent; the testimony in the cause not warranting such finding.

2d. Because the master erred in finding that the nature or character of the substance (celluloid) used by the defendant is applied in substantially the same way as claimed in said letters patent; the testimony not warranting such finding.

3d. Because the master erred in finding that this material, celluloid, is the "equivalent of hard rubber or vulcanite;" the testimony in the cause not warranting such finding.

4th. Because the master erred in finding that this material, celluloid, is clearly within the claim of said letters patent, to wit, a plate of hard rubber, or vulcanite, or its equivalent, for holding artificial teeth, or teeth and gums, substantially as described; the testimony not warranting such finding, and the claim of said letters patent not being as broad as cited by the master.

5th. Because the master erred in concluding that "the use of what is termed celluloid, in the manner described in the testimony in this cause, is an infringement of the exclusive rights of complainants under their said patent;" the testimony in this cause not warranting such
12*o* conclusion, and the manner of using celluloid described in the testimony not being the manner of using hard rubber or vulcanite described in complainants' patent.

6th. Because the master erred in not finding and reporting to the court that the testimony as to celluloid was not relevant to the matters referred to him, and involved a question of construction and other questions of law, which it was not competent for the complainant to raise before the master, or for the master to consider or decide, under the order of reference in this cause.

7th. Because the master erred in that having gone into the question as to celluloid, he did not find and report to the court upon the testi-

mony adduced before him, that the manner of using hard rubber or vulcanite, described in complainants' patent, was old in each and every particular involved in the use of celluloid for the purpose described, and that said complainants' said letters patent could therefore only be valid, if at all, for the particular process therein described (as an entirety) of making and vulcanizing the plate of hard rubber or vulcanite, or its equivalent.

8th. Because the master erred in not finding and reporting to the court, upon the testimony in this cause, that if the use of what is termed celluloid in the manner and for the purpose described in the testimony in this cause is within the claim of complainants' said letters patent, then said letters patent are shown by the said testimony to be void for want of novelty.

9th. Because the master erred in not finding and reporting to the court, upon the testimony in this cause, that to have a plate of hard rubber, or vulcanite, or its equivalent, for holding artificial teeth, or teeth and gums, substantially as described in complainants' patent, it is essential to have first a vulcanizable compound, and finally vulcanite; and that the material termed celluloid not being a vulcanizable compound, and not being vulcanized, is therefore not an equivalent of hard rubber or vulcanite, nor within the claim of complainants' patent.

10th. Because the master erred in not finding and reporting to the court, upon the testimony in this cause, that what is termed cellu-
12*p* loid does not contain any india-rubber, caoutchouc, gutta-percha, or other vulcanizable gum, nor any sulphur or other vulcanizing agent, and that, therefore, it is not an equivalent of hard rubber or vulcanite, nor within the claim of complainants' patent.

11th. Because the master erred in not finding and reporting to the court, upon the testimony in this cause, that the defendant, not having used any material except celluloid during the year 1875, had not during that year infringed upon complainants' patent, nor upon their exclusive rights under and by virtue of said letters patent.

12th. Because the master erred in exceeding his province and assuming the functions of this honorable court, so far as to inquire and to find what was an infringement, aside from the inquiry committed to him under the decretal order in this cause, filed May 27, 1875.

And to the following finding of said report, to wit:

"It being shown by the evidence that the usual price or sum charged by the complainants for a license for the use of said improvements is sixty dollars per year, and the defendant having made, used, and sold the said improvements during the years 1873, 1874, and 1875 without the license of the complainants, the master finds that the sum of one hundred and eighty dollars damages have been sustained by the complainants by reason of said infringement."

Defendant excepts:

1st. Because the master erred in finding that the defendant had made, used, and sold the said patented improvements during the year 1875; the evidence showing that during said year 1875 the defendant did not use hard rubber in making plates for artificial teeth, but used celluloid.

2d. Because the master erred in finding that the sum of one hundred and eighty dollars damages are proven to have been sustained by complainants by reason of defendant's infringement; whereas, upon the evidence in this cause, the master should have found and reported to the court only the sum of one hundred and twenty dollars, to wit, the said license fee for the years 1873 and 1874, as the sum of the damages proven, and should have found and reported to the court that in

12q the year 1875 defendant had not infringed complainants' patent, and that no damages were proven for said year 1875.

And thereupon the defendant prays that the master may be required to return to the court all the testimony in any way relating to said cause adduced before him and referred to in his said report.

And further respectfully submits that in the foregoing particulars the said report is erroneous as aforesaid, and ought to be amended and altered as aforesaid; and to these ends should be referred back to said master for his review under the further instructions of this honorable court.

All of which is respectfully submitted.

HENRY BALDWIN, JR.,
For Defendant.

PHILADELPHIA, *May* 29, 1876.

And that said exceptions have not yet been argued or passed upon by said court, but that the said cause is now pending and undetermined; wherefore, and for other reasons appearing upon the face of the complainants' bill in this cause, this defendant is advised and believes, and thereupon submits, that said proceedings in said suit against said Greene are of no force or effect in this cause.

And this defendant, further answering upon information and belief, admits that this complainant has obtained final decrees for damages in a great number of other suits; but, so as aforesaid further answering, this defendant further says that in no suit has this complainant obtained any decree for profits and damages, nor for profits or damages for the use of celluloid plates for holding artificial teeth, or teeth and gums, under any decree of any court, except when such court has, as in the instances above recited, ignorantly, and under the circumstances hereinbefore set forth, confirmed the report of a master who did not in such report specify, or state, or indicate the fact that he was finding any infringement of said patent against any defendant by the use of any other plates than plates of hard rubber or vulcanite; and this defendant is advised and believes, and thereupon avers, that no decree for

12r profits or damages has been awarded this complainant in any court upon any knowledge or understanding that by such decree the court was passing upon or confirming the master's report or finding upon the question of infringement of said reissue No. 1904, by the manufacture or sale of plates of celluloid for holding artificial teeth, or teeth and gums.

On the contrary, this defendant is informed and believes, and thereupon avers, that the only instance in which the question of infringement upon said reissued letters patent No. 1904, by making dental plates of celluloid, has been submitted to a court and passed upon judicially, was in a suit brought by this complainant and Josiah Bacon in the circuit court of the United States for the southern district of New York, in July, 1875, against one Eben M. Flagg, wherein, upon a bill and affidavits in support of the alleged infringement of said letters patent, Reissue No. 1904, by the manufacture and sale of celluloid plates for holding artificial teeth, or teeth and gums, the said complainants moved for a preliminary injunction against said Flagg; which motion was argued in September, 1875, before the Hon. Samuel Blatchford, district judge, who, after holding the question under consideration until December next ensuing, then rendered the following decision thereupon, to wit:

U. S. circuit court, southern district of New York.

THE GOODYEAR DENTAL VULCANITE CO. AND others
vs.
EBEN M. FLAGG.

"I do not find that any decision has been made in regard to the plaintiff's patent which gives to it such a construction as necessarily includes the process and substance used by the defendant. In the
13 Gardner case the defendant did not compound india-rubber with sulphur, but he compounded india-rubber with iodine, and he employed heat to harden the rubber.—(Goodyear Dental Vulcanite Co. vs. Gardner, 4 Fisher's Patent Cases, 224, 231.)

"In the Smith case the view of the court was that the material to be used under the plaintiffs' patent in carrying out the invention patented was to be india-rubber, 'and the compounds commonly employed therewith reduced to a soft plastic condition, capable of vulcanization and subsequently vulcanized.'—(Goodyear Dental Co. vs. Smith, 5 Official Gazette of Patent Office, 585.)

"It appears, from the description of the process used by the defendant in this suit, that he does not use india-rubber or any substance capable of vulcanization. That the substance he uses is one which is rendered plastic by heat, and is not hardened by heat. That heat is used in the process to soften the substance and render it plastic and not to harden it, and that the subs ance after being moulded is hardened by being cooled. It is not sufficiently clear that this process is embraced in the claim of the plaintiff's patent to warrant the granting of an injunction until one is awarded as the result of a decree for the plaintiffs on final hearing."

And this defendant is informed and believes, and thereupon avers, that thereupon said complainants discontinued said suit, and paid the costs therein.

And this defendant, further answering, further says, it is not true that, he having full knowledge of the premises alleged in said bill of complaint, and in violation of this complainants' alleged exclusive right and privilege as aforesaid, and utterly disregarding the same, has, since the 17th day of July, 1866, and before and since the said assignment of said letters patent to this complainant, the Goodyear Dental Vulcanite Company, without the license of this complainant, manufactured, used, and sold, and still continues to manufacture, use, and sell, many sets of artificial teeth, embracing the alleged improvement and invention described in said reissued letters patent No. 1904.

14 And this defendant says that he has had a license from this complainant to make, and use, and vend to others to be used, the said alleged improvement and invention under said reissue No. 1904, and has made and used said alleged invention and improvement under such license during and up to the end of June, 1874; and that since the expiration of such license, he has not made or used, or sold to others to be used, any plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth, or teeth and gums, substantially as described in said letters patent, reissue No. 1904.

15 And this defendant, further answering, denies that he has infringed upon said letters patent, reissue No. 1904, by the making of sets of artificial teeth embedded in elastic bases moulded to fit the mouth, said bases being composed of the substance known by the trade-

name of "celluloid," though he admits that he has made sets of artificial teeth upon a base of the material known by the trade-name of celluloid; but he, further answering, denies that such sets of artificial teeth are substantially the articles of manufacture described and claimed in said reissued letters patent No. 1904.

And this defendant, further answering, denies that he has infringed upon said letters patent, reissue No. 1904, by the making of sets of artificial teeth embedded in bases moulded to fit the mouth, said bases being composed of the substance known by the trade-name of "rose pearl." And he further denies that sets of artificial teeth upon a base of the material known by the trade-name of "rose pearl," are substantially the articles of manufacture described and claimed in said reissued letters patent No. 1904.

And this defendant, further answering, denies that he has used or practiced the alleged invention described and claimed in said reissue No. 1904, without the license of this complainant, in any calendar year since the 31st day of December, 187 .

And this defendant, further answering, is advised and believes, and thereupon avers, that the substance known by the trade-name of celluloid does not contain any caoutchouc, India rubber, gutta percha, or other vulcanizable gum, nor any sulphur or other vulcanizing ingredient; that said material or substance called celluloid is not a vulcanizable compound, and is not vulcanized in the process of manufacturing a dental plate, or a case or set of artificial teeth, and is not an equivalent of hard rubber or vulcanite, nor within the claim of said letters patent, reissue No. 1904.

And this defendant, so as aforesaid further answering, says, that he is informed and believes, and thereupon avers, that said substance, known by the said name of celluloid, was invented by John W. Hyatt, jr., and Isaiah Smith Hyatt, who also invented a certain process
16 or method of manufacturing said substance, for which inventions they obtained letters patent of the United States, as follows, to wit: No. 105338, dated July 12, 1870; reissued to the Celluloid Manufacturing Company, mesne assignees of said John W. Hyatt, jr., and Isaiah S. Hyatt, June 23, 1874, reissue No. 5928. Also, that letters patent No. 113055, dated March 28, 1871, were issued to the Albany Dental Plate Company, assignees of said Isaiah S. Hyatt and John W. Hyatt, jr., and Jesse A. Perkins, for an improvement in forming said material made by the aforesaid patented process into a blank or plate, for use as a dental base. Also, that letters patent No. 121522, dated December 5, 1872, were issued to the said Albany Dental Plate Company, as assignees of said John W. Hyatt, jr., and said Isaiah S. Hyatt, for an improved apparatus for moulding said dental plates of said substance designated as celluloid. And that letters patent No. 152232, dated June 23, 1874, were issued to the Celluloid Manufacturing Company, assignees of said Isaiah S. Hyatt and John W. Hyatt, jr., for improved apparatus and process for moulding said substance called celluloid. And this defendant, further answering, says, that he is informed and believes, and thereupon avers, that the celluloid used by him as aforesaid was made and shaped by the processes described in said letters patent No. 105338, reissue No. 5928, and No. 113055; and he further says, that in making dental plates of said substance he has used the processes and substantially the apparatus described in said letters patent No. 113055, No. 121522, and No. 152232; and this defendant, further answering, says, upon information and belief, that the celluloid blanks or plates which he has used as aforesaid were made under the sanction

of said letters patent, and sold for such use under the authority and license of the Celluloid Manufacturing Company, the owners of said letters patent.

And this defendant, still insisting upon each and all of the foregoing objections to the complainant's bill, and to the aforesaid reissued letters patent numbered one thousand nine hundred and four, further answering, says, by way of further defences to said bill of complaint, that he is informed and believes, and upon information and belief avers—

17 I. That the pretended invention or improvement, or a substantial and material part thereof, or substantial and material parts thereof, described and set forth, and claimed as new in the reissued letters patent numbered one thousand nine hundred and four, and dated March twenty-first, in the year one thousand eight hundred and sixty-five, was or were not described nor specified nor represented nor suggested nor indicated in the specifications, drawings, or model deposited in the United States Patent Office in connection with the application of said Cummings for the original letters patent numbered forty-three thousand and nine, and dated June 7, A. D. 1864, before the issue of said original letters patent; nor was nor were such pretended invention or improvement nor such part or parts thereof as aforesaid described or specified or represented or indicated or suggested in the specification or drawings of said original letters patent numbered forty-three thousand and nine, and issued June 7, 1864, but that the said pretended invention and improvement, or the said substantial and material part or parts thereof, was or were first described and set forth and claimed in the new or amended and corrected description and specification annexed to the reissued letters patent (granted and issued upon the surrender and cancellation of said original letters patent) numbered one thousand eight hundred and forty-eight, and dated January tenth in the year one thousand eight hundred and sixty-five, and that said pretended invention and improvement, or said substantial and material part or parts thereof, was or were again described and set forth and claimed in the new or amended description and specification annexed to the reissued letters patent (granted and issued upon the surrender and cancellation of said first mentioned reissued letters patent No. 1848, dated January 10, 1865) numbered one thousand nine hundred and four, and dated March 21, 1865, by reason of which facts said letters patent numbered (reissue) one thousand nine hundred and four, and dated March 21, 1865, were granted and issued contrary to law, and were and are null and void.

18 II. That in view of the state of the art at the time of said supposed invention by said Cummings, the claim set forth in the new or amended and corrected description and specification annexed to the reissued letters patent No. 1904, dated March 21, 1865, and issued as mentioned in said bill of complaint, does not cover or comprise any device or invention or improvement which is by law the proper subject of letters patent of the United States, but that said claim is wholly invalid, void, and inoperative in law.

III. That the said John A. Cummings was not the original and first inventor or discoverer of the thing patented, or of a substantial and material part, or of substantial and material parts thereof, claimed as new in said reissued letters patent numbered one thousand nine hundred and four, and dated March 21, 1865, but that long prior to the pretended invention thereof by said Cummings, the same thing, or a substantial and material part, or substantial and material parts thereof, claimed as new in said reissued letters patent, was invented by or known to and used

by the following named persons, and at the following named places, to wit:

George E. Hawes, deceased, at New York City.

C. O. Crosby, of and at New Haven, Connecticut.

William A. Royce, of and at Newburgh, New York.

Elias Wildman, of and at Philadelphia, Pennsylvania.

Charles Goodyear, deceased, formerly of New York City, at said New York City, and at New Haven, Connecticut, and in London, England, and Paris, France.

Charles Goodyear, jr., of New Rochelle, New York, at New York City, and at New Haven, Connecticut, and at London, England, and Paris, France.

Asa Hill, deceased, at Norwalk, Connecticut.

Emanuel G. Blackman, of and at Norwalk, Connecticut.

C. S. Putnam, deceased, at New York City.

L. E. Christopher, of and at New York City.

G. A. Foster, of and at Utica, New York.

Henry B. Goodyear, of and at New Haven, Connecticut, and at New York City.

Willard Ball, of and at Walpole, New Hampshire.

19 Nelson Goodyear, deceased, of and at New York City, and at New Haven, Connecticut.

Jehial Parmly, of and at New York City.

John Lovejoy, of New York City, and, if not deceased, of New York City.

Archibald McIlroy, of Greenwich, Connecticut, and at New York City.

IV. That the said John A. Cummings was not the original and first inventor or discoverer of the thing patented, or of a substantial and material part, or of substantial and material parts thereof, claimed as new in said reissued letters patent No. 1904, dated March 21, 1865, but that anterior to the supposed discovery thereof by said Cummings the thing patented, or a substantial and material part thereof, or substantial and material parts of the thing patented or claimed as new in said reissued letters patent No. 1904, had been described in the following printed publications, to wit:

The American Journal of Dental Science. Edited by Chapin A. Harris, M. D., D. D. S., etc. New series, volume I. Philadelphia, Lindsay & Blackiston; Baltimore, Armstrong & Berry; New Orleans, John Ball, 1850. Pages 1 to 12 (both inclusive) of said volume, being the number of said journal for October, 1850. Said American Journal of Dental Science, volume IV, new series, at pages 79 to 93; also at page 176; and also at pages 223–226; being respectively the numbers of said journal for October, 1853, and for January, 1854. Also in said American Journal of Dental Science, volume VI, new series, at pages 477, 478, and 479, being the number of said journal for July, 1856.

The Dental News Letter. Vol. IV., January, 1851, No. 2. Jones, White & McCurdy, proprietors and publishers, 120 Arch street, Philadelphia, 263 Broadway, New York, and branch at 23 Tremont Row, Boston; pp. 59, 60, 61, 62, and 63 of said number of said publication.

The Dental News Letter. Edited by J. D. White and J. R. McCurdy. Published quarterly by Jones, White & McCurdy, proprietors and

20 publishers, 528 Arch street, Philadelphia, 335 Broadway, New York, and branch at 16 Tremont Row, Boston. Volume XI, April, 1858, No. 3; pp. 170, 171, and 172 of said number of said publication. Also in said Dental News Letter for July, 1858 (being No. 4 of said vol. XI), at pages 253, 254, and 255, and on the second page of the

advertisements at the back of said number of said work. Also in said Dental News Letter for July, 1859 (being No. 4 of vol. XII), at pages 289 and 290 of said number of said publication.

The Vulcanite. A Quarterly Journal, devoted to the Science of Mechanical Dentistry. Edited by B. W. Franklin, New York. Published by the American Hard Rubber Co., No. 640 Broadway. Vol. I, No. 1, May, 1860, pages 2 to 14 (both inclusive); vol. I, No. 2, August, 1860, pages 65, 66, 67, 68, 69, and 70; also vol. I, No. 3, November, 1860, at pages 99, 100, 101, 102, 103, 104, and 105; also pages 130 to 132; also vol. I, No. 4, February, 1861, pages 164 to 168, and pages 178, 179, and 180; also vol. II, No. 1, May, 1861, pages 32 to 36, pages 40 to 43; also vol. II, No. 2, August, 1861, pages 106 to 110; also vol. II, No. 3, November, 1861, pages 142 to 146; also vol. II, No. 4, February, 1862, pages 176 to 181.

The Principles and Practice of Dental Surgery. By Chapin A. Harris, M. D., D. D. S., etc., etc. Philadelphia, Lindsay & Blackiston. Fifth edition, 1853. Pages 736, 737, 738, 739, and 740.

The New York Dental Recorder. Devoted to the theory and practice of surgical, medical, and mechanical dentistry. Volume I, pages 18, 19, and 20 of No. 1, October, 1851.

The American Journal of Dental Science. New series. Volume II, at page 332; being the number of said journal for January, 1852.

Comptes-Rendus Hebdomadaires des Séances de l'Académie des Sciences. Publiés conformément à une décision de l'académie en date du 13 Juillet, 1835. Par MM. les secrétaires perpétuels. Tome trente-troiésime, Juillet-Décembre, 1851. Paris: Bachelier, imprimeur-libraire de l'ecole polytechnique au bureau des longitudes, etc., Quai des Augustins, No. 55; 1851; at page 126.

21 The Dental Register of the West. Published quarterly, by order of the Mississippi Valley Association of Dental Surgeons. Cincinnati: John D. Thrope, printer, No. 12 West Fourth street. 1850; at pages 38, 39, and 40; being the number of said Register for October, 1850.

The New York Dental Recorder, devoted to the theory and practice of surgical, medical, and mechanical dentistry. Edited by C. C. Allen, M. D., dentist. Volume III. New York: Printed by E. N. Grossman, 12 Spruce street. 1849. Page 80, being the number of said journal for January, 1849.

The New York Dental Recorder. Devoted to the theory and practice of surgical, medical, and mechanical dentistry. Edited by C. C. Allen, M. D., dentist. Volume IV. New York: Printed by Grossman & son, 59 Ann street. 1850. Pages 286, 287, and 288, being the number of said journal for September, 1850

Revue Odontotechnique Franco-Amèricane. Sous la direction de C. S. Putnam (de New York). Publiée tous les Mois. On s'abonne au bureau du journal, 26 Rue de la Chaussée d'Antin, 26 Juin, 1860. Pages 160, 161, and 162 in said number (being No. 5 of vol. 1) of said printed publication. Also in the number of said last-mentioned printed publication for November, 1860 (sous la direction de T. R. Hammond, de New York), being No. 11 of vol. I, at pages 297, 298, 299, and 300 in said number.

Also, that the pretended invention or improvement described and set forth and claimed in said reissued letters patent No. 1904, or a substantial and material part thereof, or substantial and material parts thereof, claimed as new, had been, long prior to the alleged invention or discovery of said Cummings, patented or described in the following letters patent and

application for letters patent of the United States, to wit: letters patent No. 8075, granted to Nelson Goodyear, of New York City, dated May 6, 1851; reissued letters patent No. 556 and reissued letters patent No. 557, granted to Henry B. Goodyear, administrator of Nelson Goodyear, deceased, each dated May 18, A. D. 1858, being reissues of said letters patent No. 8075; letters patent No. 9968, granted to Charles Goodyear,
of New Haven, Connecticut, assignee of Charles Goodyear and
22 Robert Haering, dated April 12, 1853; the application of Robert Haering, of New York, New York, for letters patent for a new and improved mode of setting artificial teeth, filed in the United States Patent Office, March 25, 1856, and upon which letters patent were issued to John B. Newbrough, assignee of said Haering, under date of January 19, 1869, No. 85927; letters patent No. 8621, granted to John Allen, of Cincinnati, Ohio, dated December 26, 1851; letters patent No. 12156, granted to Sharpless Clayton, of West Chester, Pennsylvania, dated January 2, 1855; letters patent No. 16708, granted to Alfred A. Blandy, of Baltimore, Maryland, dated March 3, 1857; letters patent No. 19916, granted to George Diffenbach, of New York, New York, dated April 13, 1858; letters patent No. 10847, granted to Mahlon Loomis, of Cambridgeport, Massachusetts, dated May 2, 1854; and also patented or described in the following English letters patent, to wit:

No. 11135, dated March 18, 1846, to Thomas Hancock.
No. 11208, dated May 15, 1846, to Charles Hancock.
No. 11209, dated May 15, 1846, to H. V. Bartlett.
No. 12241, dated August 15, 1848, to E. T. Truman.
No. 13542, dated March 4, 1851, to A. V. Newton.
No. 24, dated October 1, 1852, to Moses Poole.
No. 43, dated October 1, 1852, to Moses Poole.
No. 577, dated March 14, 1855, to Charles Goodyear, jr.
No. 893, dated April 21, 1855, to Henri Schoofs.
No. 1232, dated May 1, 1857, to Alfred A. Blandy.
No. 193, dated January 21, 1859, to James Childs.
No. 1842, dated August 9, 1859, to F. L. Lawrence.
No. 2295, dated October 8, 1859, to James Childs.
No. 2790, dated December 8, 1859, to John Macintosh.
No. 4, dated January 2, 1860, to H. A. Dewar.
No. 1549, dated June 25, 1860, to Matthew Cartwright.
No. 1421, dated June 11, 1859, to G. C. Ash.

V. That the pretended invention or improvement described and set forth and claimed in said last-mentioned reissued letters patent numbered one thousand nine hundred and four, and dated March 21, 1865, as here-
23 inbefore set forth, or a substantial and material part thereof, or substantial and material parts thereof, claimed as new, was or were in public and common use among dentists and on sale to dentists and others and by dentists and others throughout the United States at the time of and before the application for said reissued letters patent last mentioned, and had so been in public and common use and on sale for more than two years prior to such application, and that the said pretended invention or improvement described and set forth and claimed in said last mentioned reissued letters patent, or a substantial and material part thereof or substantial and material parts thereof claimed as new, was or were in public and common use among dentists and others and on sale to dentists and others and by dentists and others throughout the United States at the time of and before the application for the original letters patent numbered forty-three thousand and nine, and dated June 7, 1864, as hereinbefore set forth, and had so been in public and common use and on sale

for more than two years prior to such application for said original letters patent, and such use and sale as aforesaid was had, inter alias, by the following-named persons, and at the following-named places respectively, to wit:

Clarke S. Putnam, deceased, at New York City.

Bradley W. Franklin, of and at the city of New York.

The American Hard Rubber Company, of and at Bethany, Connecticut, and of and at Flushing, New York, and of and at New York City.

Henry B. Goodyear, of and at New Haven, Connecticut.

E. E. Crofoot, of and at Hartford, Connecticut.

A. W. Todd, of and at Montgomery, Alabama.

James Taylor, of and at Cincinnati, Ohio.

Hawes, Bro. & Seabury, of and at Providence, Rhode Island.

T. H. Burras, of and at New York City.

Spencer Roberts, of and at Philadelphia, Pennsylvania.

A. E. Pursell, of and at Madison, Indiana.

S. S. Blodgett, of and at Ogdensburg, New York.

C. Palmer, of and at Warren, Ohio.

R. Russell, of and at Nashville, Tennessee.

Miller & Hale, of and at Rockford, Illinois.

24 John McCalla, of and at Lancaster, Pennsylvania.

F. A. Bevin, deceased, at Walpole, New Hampshire, and at Boston and Cambridge, Massachusetts, and at New Haven, Connecticut.

Ira A. Salmon, of and at Boston, Massachusetts.

Willard Ball, of and at Walpole, New Hampshire.

Nathan C. Keep, of and at Boston, Massachusetts.

Roswell Cutler, of and at Boston, Massachusetts.

Samuel Mallett, of and at New Haven, Connecticut.

Elbridge G. Leach, of Stoughton, Massachusetts, at said Stoughton, and at Boston and at Cambridgeport, Massachusetts.

Seth P. Miller, of and at Worcester, Massachusetts.

Dennis S. Bartlett, of and at Boston, Massachusetts.

Ambrose Lawrence, of and at Lowell, Massachusetts.

VI. That (still denying that said Cummings was the original or first inventor of the pretended invention or improvement described and set forth and claimed in said reissued letters patent numbered one thousand nine hundred and four) the pretended invention or improvement described and set forth and claimed in said last-mentioned reissued letters patent, or a substantial and material part thereof, or substantial and material parts thereof, claimed as new, had been in public use and on sale, with the consent and allowance of said Cummings, for more than two years before his application for said reissued letters patent, and for more than two years prior to his application for said original letters patent numbered forty-three thousand and nine, as hereinbefore set forth; and such use and sale thereof was had and made as aforesaid, with the consent and allowance and with the knowledge and acquiescence of said Cummings, among others, by the following-named persons and at the following-named places, to wit:

F. A. Bevin, deceased, late of Boston, Massachusetts, at said Boston, at Cambridge, Massachusetts, and at New Haven, Connecticut, and elsewhere.

W. A. Bevin, of New York, at Boston, Massachusetts.

N. C. Keep, of and at Boston, Massachusetts.

I. A. Salmon, of and at Boston, Massachusetts.

25 Seth P. Miller, of and at Worcester, Massachusetts.

Roswell Cutler, of and at Boston, Massachusetts.

Ambrose Lawrence, of and at Lowell, Massachusetts.
B. W. Franklin, of and at New York City.
The American Hard Rubber Company, of Flushing, New York, and of Bethany, Connecticut, and of New York City, at New York City and elsewhere.

VII. That (still denying that said Cummings was the original and first inventor of the pretended invention or improvement described and set forth and claimed in said reissued letters patent numbered one thousand nine hundred and four) the said Cummings, previous to the date of the said reissued letters patent, and previous to the date of his application therefor, and previous to the date of the reissued letters patent numbered one thousand eight hundred and forty-eight, as hereinbefore set forth, and previous to his application therefor, and previous to his application for said original letters patent No. 43009, suffered the said pretended invention and improvement, or a substantial and material part, or substantial and material parts thereof described and set forth and claimed as new in the amended and corrected specification signed by him, and annexed to said reissued letters patent numbered one thousand eight hundred and forty-eight, and again described and set forth and claimed in said reissued letters patent numbered one thousand nine hundred and four, to be used freely and fully by the public for more than two years and acquiesced in and permitted and assented to such use without asserting any claim or right thereto, and thereby waived and abandoned the same, and dedicated the same to public use, and surrendered and forfeited or lost any right he might have had in or to said pretended invention or improvement, or to letters patent of the United States therefor, or under such letters patent.

VIII. That by English letters patent, numbered 577, and dated March 14, A. D. 1855, granted and issued to Charles Goodyear, jr., then residing in Paris, France, the pretended invention or improvement
26 described and set forth and claimed in said reissued letters patent numbered one thousand nine hundred and four, and dated March 21, 1865, or a substantial and material part, or substantial and material parts of said pretended invention or improvement claimed as new, was or were patented in a foreign country more than six months prior to the application for said reissued letters patent last mentioned, and more than six months prior to the application, as hereinbefore set forth, for the reissued letters patent numbered one thousand eight hundred and forty-eight, and more than six months prior to the application, as hereinbefore set forth, for the original letter patent numbered forty-three thousand and nine, and that the same had been introduced into public and common use in the United States (as hereinbefore more particularly set forth), prior to the application for said reissued letters patent, respectively, and prior to the application for said original letters patent, and more than two years prior to said applications, respectively, for said reissued letters patent numbered one thousand eight hundred and forty-eight and one thousand nine hundred and four, and more than two years prior to said application for said original letters patent numbered forty-three thousand and nine, wherefore said reissued letters patent numbered one thousand nine hundred and four were and are null and void.

IX. That (still insisting upon the aforesaid defences and each of them) the pretended invention or improvement described and set forth and claimed in said reissued letters patent numbered one thousand nine hundred and four, and dated March 21, 1865, or a substantial and material part, or substantial and material parts, of said pretended inven-

tion or improvement claimed as new, having been so as last aforesaid patented in a foreign country more than six months prior to the application for said original letters patent numbered forty-three thousand and nine, said letters patent numbered forty-three thousand and nine, and dated June 7, 1864, and said reissued letters patent numbered one thousand nine hundred and four, and dated March 21, 1865, were, by the acts of Congress in such cases made and provided, limited to
27 the term of seventeen years from the date or publication of said foreign letters patent granted to Charles Goodyear, jr., as last mentioned, and therefore ceased to be of any force or effect on or before the fifteenth day of March, in the year one thousand eight hundred and seventy-two, or on or before the ninth day of September, in said year one thousand eight hundred and seventy-two, according as the date or publication of said foreign letters patent shall be held to have been the fourteenth day of March or the eighth day of September, in said year one thousand eight hundred and fifty-five.

X. That the schedule or specification and claim of said Cummings annexed to and forming part of said reissued letters patent numbered one thousand nine hundred and four, is informal, insufficient, and void in law, and does not and cannot entitle the said Cummings or his assigns or legal representatives to any exclusive use, possession, or enjoyment of the pretended invention or improvement described and specified in said schedule or specification and claim; and the said Cummings or his assigns or legal representatives cannot hold or enjoy the exclusive right or title to said pretended invention or improvement by virtue of his said reissued letters patent. That the pretended invention or improvement described and set forth and claimed in the said reissued letters patent numbered one thousand nine hundred and four consists only in the substitution of a material well known and in public use long prior to the pretended invention or discovery of said Cummings for other materials which had long theretofore been known and used for the same purposes, in the same mode, and by the same means described in said reissued letters patent, or in filling the long theretofore well known moulds with the long theretofore well-known preparations of India rubber or caoutchouc instead of with metal or other materials, and subjecting the long theretofore well-known material to the long theretofore well-known process of vulcanization in the long theretofore well-known way.

And this defendant, still insisting that such substitution of hard rubber or vulcanite, or its equivalent, was not first invented
28 by said Cummings, but had long prior to his pretended invention been known and used by the persons and at the places specified in the foregoing clauses of this answer marked III and V, and described in the publications and patents specified in the foregoing clause of this answer marked IV, further insists that even if said Cummings were the original and first inventor of such substitution of a plate of vulcanite for the plates of different materials theretofore used, such substitution of one material for another is not patentable subject-matter for letters patent of the United States, and that therefore said reissued letters patent numbered one thousand nine hundred and four were and are null and void.

XI. That the pretended invention or improvement described and set forth and claimed in the said reissued letters patent numbered one thousand nine hundred and four embraces or comprises as material and substantial parts, or as a substantial and material part thereof, claimed as new, the means or mode or method of obtaining the impression of the mouth and of preparing the moulds and of setting the teeth in the

moulds, or the method of forming said hard rubber or vulcanite plates set forth in said reissued letters patent, and that said reissued letters patent, therefore, were and are null and void, for the following among other reasons:

First. Because said Cummings was not the original and first inventor of such means or mode or method of obtaining the impression of the mouth, or of preparing the moulds, or of setting the teeth in the moulds, or of the method of forming said hard rubber or vulcanite plates set forth in said reissued letters patent, but the same, or substantially the same means or mode or methods, had been known and used and patented and described in public works long prior to such supposed invention by said Cummings, by the persons and at the places and in the publications and patents specified in the foregoing clauses of this answer, marked III, IV, and V.

Second. Because such pretended invention or improvement, or said substantial and material parts, or said substantial and material
29 part thereof claimed as new in said reissued letters patent, were or was not described, suggested, or indicated in the specification or drawings of said original letters patent numbered forty three thousand and nine, but was new matter interpolated in said reissued letters patent numbered one thousand nine hundred and four, as hereinbefore stated, such interpolation of said new matter in said reissued letters patent making a radical change in the specification and in the pretended invention or improvement described and set forth and claimed in said reissued letters patent, from the pretended invention or improvement described and set forth and claimed in said original letters patent numbered forty three thousand and nine.

XII. That said John A. Cummings was not the inventor of the material known as hard rubber or vulcanite, nor of any substance or material which is the equivalent of hard rubber or vulcanite; nor the inventor of the process of making the plate of hard rubber or vulcanite or its equivalent, substantially as described in said reissued Letters Patent No. 1904, but that, on the contrary, the said material was invented and patented by Nelson Goodyear, as hereinbefore more particularly set forth; and said process was invented and published by John E. Hawes, and by others, and patented by said Nelson Goodyear, by his administrator Henry B. Goodyear, by Thomas Hancock, by Charles Goodyear, jr., and by others, as more particularly specified in the foregoing clauses of this answer marked IV and V; also patented to Charles Goodyear by letters patent of the United States, dated June 15, 1844, reissued in two divisions, dated December 25, 1849; and that by reason of the fact that said Cummings was not the inventor of the said material, nor of the said process, said reissued letters patent No. 1904 are null and void.

XIII. That the said reissued letters patent No. 1904 describe and specify and claim the plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth, or teeth and gums, substantially as described; that is, when made by the process described, which process is an entirety, and includes the conversion of the vulcanizable
30 plastic compound into the vulcanized product; and that the substance called celluloid not being a vulcanizable compound, and not being vulcanized or converted into a vulcanized compound, it is not an equivalent of hard rubber or vulcanite, and a plate of celluloid for holding artificial teeth, or teeth and gums, is not an equivalent of the plate of hard rubber or vulcanite for holding artificial teeth, or teeth and gums, substantially as described in said reissue 1904, nor is the manu

facture, use, or sale of such plates made of celluloid an infringement of said reissue No. 1904.

XIV. That the process of making the plate of celluloid for holding artificial teeth, or teeth and gums, or the process of making a set of artificial teeth on a base of celluloid, is not the same, or substantially the same as the process of making the plate of hard rubber or vulcanite, or its equivalent for holding artificial teeth, or teeth and gums, substantially as described in said reissued letters patent No. 1904, or the process of making a set of artificial teeth on a base of hard rubber or vulcanite or its equivalent, and that by reason of the differences between said processes respectively, as well as by reason of the differences between celluloid and hard rubber, or vulcanite or its equivalent, the manufacture, use, or sale of sets of artificial teeth on a base of celluloid is not an infringement of said reissued letters patent No. 1904.

XV. That the material called celluloid being a new substance or compound, not containing either of the essential ingredients of hard rubber or vulcanite, or its equivalent, nor any substitute for either of said ingredients, performing the functions of the rubber or of the sulphur, and said new substance or compound, celluloid, not being known at the date of said Cummings's alleged invention of the alleged improvement patented in said reissued letters patent No. 1904, and not being known at the date of said Cummings's alleged invention, nor at the date of said reissued letters patent No. 1904, nor at the date of said original letters patent No. 43009, as a proper substitute for hard rubber or vulcanite, or its equivalent, the use of said new substance or compound as a base for artificial teeth is not an infringement of the said reissued letters patent No. 1904.

31 Without this, that there is any other matter or thing in the said complainant's bill of complaint contained material or necessary for this defendant to make answer unto, and not herein and hereby well and sufficiently answered, traversed, confessed, and avoided, or denied, true to the knowledge or belief of this defendant.

All which this defendant is willing to aver, maintain, and prove as this honorable court shall direct, and humbly prays to be hence dismissed with his reasonable costs and charges in this behalf most wrongfully sustained.

CHAS. G. DAVIS.

UNITED STATES OF AMERICA,
District of Massachusetts, ss:

Charles G. Davis, the above named defendant, being duly sworn, says that he has read the foregoing answer by him subscribed, and knows the contents thereof, and that the same is true of his own knowledge, except as to matters which are therein stated to be on information or belief, and as to those matters he believes them to be true.

Subscribed and sworn to before me this 20th day of July, A. D. 1876.
[SEAL.] CHARLES W. CLIFFORD,
U. S. Commissioner.

32 On the twenty-fifth day of July, A. D. 1876, the following replication was filed, namely:

Replication.

These repliants, saving and reserving unto themselves all and all manner of advantage of exception to the manifold insufficiencies of the

said answer, for replication thereunto say that they will aver and prove their said bill to be true, certain, and sufficient in the law to be answered unto; and that the said answer of the defendants is uncertain, untrue, and insufficient to be replied unto by these repliants; without this, that any other matter or thing whatsoever, in the said answer contained, material or effectual in the law to be replied unto, confessed and avoided, traversed or denied, is true. All which matters and things these repliants are and will be ready to aver and prove, as this honorable court shall direct; and humbly pray as in and by their said bill they have already prayed.

BROWNE & HOLMES,
Complainants' Solicitors.

32*a* On the fourteenth day of September, A. D. 1876, the following stipulation was filed, namely:

Stipulation.

United States circuit court, district of Maine.

THE GOODYEAR DENTAL VULCANITE COMPANY
vs.
D. B. STROUT.

SAME
vs.
CHARLES E. HUSSEY.

SAME
vs.
JEREMIAH MASON.

SAME
vs.
GEORGE E. TOWLE.

SAME
vs.
NATHAN WOODBURY ET AL.

SAME
vs.
CHARLES F. WARD.

The proofs in the above-entitled causes shall be taken together, and shall be the proofs for final hearing in all other causes begun by the Goodyear Dental Vulcanite Company on the Cummings patent since March 1, 1876, in which answers admitting or averring the use by the defendant of what are known as sets of teeth on the celluloid base have been filed or shall become due and be filed, before or on the August rule day, 1876, and which are defended by Henry Baldwin, jr., esq., as of counsel.

The defendants may have until the fourth Monday of July, 1876, to file all answers coming due on the July rule day.

32*b* It is understood that the defendants in all of said causes make their celluloid sets of teeth as described in the proofs in the above-entitled causes.

A printed copy of said proofs shall be filed in each other district in which such a suit is pending, in which such counsel shall have filed such answers.

The decision made in the above-entitled causes, or in the one of them that shall be first heard and decided, shall stand as the decision in all the other causes referred to in this stipulation, upon the question whether celluloid sets of teeth infringe the plaintiff's patent, and decrees may be entered accordingly.

The plaintiff may, in place of the above-entitled causes, bring one or more of said similar causes to hearing in any other district upon similar pleadings, and upon said proofs, and the decision of said cause or causes upon said question shall stand as the decision in all the causes referred to in this stipulation, and decrees may be entered accordingly.

The proofs shall be printed as fast as taken by the party on whose behalf they are taken, and twenty five copies shall, within ten days after the proofs are closed, be exchanged.

This stipulation shall not prevent the plaintiffs from making further proof of infringement by the use of other materials than celluloid, where any answer denies such use.

New York, June 27, 1876.

B. F. LEE, *for Complainants.*
C. A. SEWARD,
Per E. LUTHER HAMILTON,
Sol'r for Def'ts.
HENRY BALDWIN, JR.,
Of Counsel for Def'ts.

The following is a list of cases pending in the United States circuit court for the district of Massachusetts entitled to the benefits of the stipulation, a copy of which is hereto prefixed:

Daniel Lane, William F. Mead, Samuel W. Cook et al., Charles W. Estabrook, David J. Fuller et al., Arthur W. Howland, John W.
32c Gould, James H. Kidder, William L. Gulliver, David T. Porter, George F. Harwood, William Sellers, Edward B. Nettleton, Francis J. Stevens, H. W. Watkins, Herbert E. Wales, Samuel B. Bartholomew, Edward A. Dimmick, Charles H. Osgood, Elbridge Baker, David K. Hitchcock, Albion M. Dudley, Joseph W. Sawyer, Joseph E. Fiske, Samuel J. McDougall, Joseph Austin, H. C. Doyle, John T. Codman, Moses K. Bartlett, George C. Ainsworth, Oliver P. Rogers, Francis Bourne, Samuel G. Henry, Lory B. Fenderson, John F. Adams, Frank N. Horn, Henry F. Bishop, James J. Mulloy, Clarence J. Cheney, Wilkens Allen, J. Winslow Chapman, Samuel S. Silva, Rufus E. Strong, Charles E. Pousland, William F. Davis, Leonidas H. Andrews,
32d Cyrus W. Cross, Dennis S Bartlett, Daniel Holden, Elmore F. Brackett, Henry S. Gould, Bartlett B. Chandler, Albert A. Cooke, Nathaniel A. Glover, Charles F. Beard, Daniel G. Harrington, William H. Bond, Julius Thompson, George Williams, William H. Channing, Charles G. Davis, Henry E. Mann, James C. Mara, Fred'k Nesbitt, Edward Stetson, David P. Ward et al.

BROWNE & HOLMES,
Sol'c'rs for Compl't.
E. LUTHER HAMILTON.

A copy of the "printed copy of said proofs" was filed in the clerk's office of the circuit court for this district of Massachusetts pursu-
32e ant to the foregoing stipulation.

Decree.

This cause was thence continued to the October term of this court, A. D. 1876, when the same was set down for hearing and fully heard by the court upon the pleadings, and the "printed copy of said proofs" filed pursuant to the stipulation of the parties hereto. This cause was thence continued under advisement to this present term, when, to wit, October 5th, 1877, the opinion of the court in this cause is read. It is thereupon ordered, adjudged, and decreed by the court that the bill of complaint in this cause be, and the same is hereby dismissed, with costs to the said Charles G. Davis, defendant, taxed at .

32*f* *Appeal.*

From this decree the said complainants, in open court, claim an appeal to the Supreme Court of the United States, and give good and sufficient security to answer all damages and costs if they fail to make their plea good, which said security being approved by the court said appeal is allowed accordingly.

A true record.

Attest:

JOHN G. STETSON,
Clerk.

32*g* *Bond to party on appeal.*

Know all men by these presents, that we, The Goodyear Dental Vulcanite Company, a corporation established by law of the State of New York, as principal, and Josiah Bacon, of Boston, in the State of Massachusetts, Thomas H. Bacon, of Brookline, in said State of Massachusetts, and Henry F. Durant, of Boston, in said State, as sureties, are held and firmly bound unto Charles G. Davis, of New Bedford, in the State of Massachusetts, in the full and just sum of three thousand dollars, to be paid to the said Charles G. Davis, his certain attorney, executors, administrators, or assigns; to which payment well and truly to be made we bind ourselves, our heirs, executors, and administrators, jointly and severally, by these presents, sealed with our seals, and dated the thirteenth day of October, in the year of our Lord one thousand eight hundred and seventy-seven:

Whereas lately at a circuit court of the United States within and for the district of Massachusetts, in a suit in equity depending in said court between said Goodyear Dental Vulcanite Company, complainants, and the said Charles G. Davis, defendant, decree was rendered against the said Goodyear Dental Vulcanite Company, and the said Goodyear Dental Vulcanite Company having obtained an appeal to remove the said cause to the Supreme Court of the United States to reverse the decree in the aforesaid suit, and a citation directed to the said Davis, citing and admonishing him to be and appear at the October term of 1877 of the Supreme Court of the United States, to be holden at Washington, to wit, on the third Monday of said October term of said Supreme Court:

Now, the condition of the above obligation is such, that if the said Goodyear Dental Vulcanite Company shall prosecute their said appeal to effect, and answer all damages and costs if they fail to make their

plea good, then the above obligation to be null and void; otherwise to remain in full force and virtue.

GOODYEAR DENTAL VULCANITE CO.,
[L. S.] By JOSIAH BACON, *Treasurer.*
JOSIAH BACON. [L. S.]
THOMAS H. BACON. [L. S.]
HENRY F. DURANT. [L. S.]

Approved:

JOHN LOWELL,
District Judge.

A true copy of the bond taken by the judge at the time of allowing the appeal named in said bond, which bond is on file in the office of the circuit court of the United States for the first circuit and district of Massachusetts.

Attest:

JOHN G. STETSON,
Clerk U. S. C. C., Mass. Dist.

33 The following is a copy of the printed copy of proofs filed in the clerk's office by the complainants pursuant to the stipulation filed September 14th, 1876, and is the evidence for complainants, and the evidence for the complainants in reply, used at the hearing of said cause before this circuit court, namely:

Circuit court of the United States, district of Maine.—In equity.

THE GOODYEAR DENTAL VULCANITE Company
v.
DAVID B. STROUT.

SAME
v.
CHARLES E. HUSSEY.

SAME
v.
JEREMIAH MASON.

SAME
v.
GEORGE F. TOWLE.

SAME
v.
NATHAN WOODBURY ET AL.

SAME
v.
CHARLES F. WARD.

EVIDENCE FOR COMPLAINANTS.

Testimony taken on behalf of complainants for a final hearing under rule sixty-seven of the supreme court, in equity, as amended, before John A. Shields, esq., special examiner, duly appointed by the circuit court of the United States for the district of Maine.

NEW YORK, *June* 8, 1876—11 *a. m.*

Present, B. F. Lee, esq., of counsel for complainants; and Hon. William D. Shipman and E. Luther Hamilton, esq., of counsel for defendants.

At request of counsel for defendants, the hearing is adjourned to June 9, 1876, at 10 a. m.

34 NEW YORK, *June* 9, 1876—10 *a. m.*

Present, of counsel for complainants, Edward N. Dickerson and B. F. Lee, esqs.; and Hon. Wm. D. Shipman and Henry Baldwin, jr., esq., of counsel for defendants.

Counsel for complainants offers in evidence a certified copy of letters patent of the United States granted to John A. Cummings, for improvements in artificial gums and palates, dated June 7, 1864, numbered 43009, and the same is marked Complainants' Exhibit A, J. A. S., Exr.

Also, certified copy of assignment dated March 1, 1864, from John A. Cummings to G. H. P. Flagg and H. D. Osgood, and the same is marked Complainants' Exhibit B, J. A. S., Exr.

Also, certified copy of assignment dated May 16, 1864, from John A. Cummings to Joseph Gavett, and the same is marked Complainants' Exhibit C, J. A. S., Exr.

Also, certified copy of assignment dated July 30, 1864, from John A. Cummings, George H. P. Flagg, Herman D. Osgood and Joseph Gavett, to the Dental Vulcanite Company, and the same is marked Complainants' Exhibit D, J. A. S., Exr.

Also, an exemplified copy, under the great seal of the Commonwealth of Massachusetts, of the certificate of the incorporation of the Dental Vulcanite Company, dated August 1, 1864, and the same is marked Complainants' Exhibit E, J. A. S., Exr.

Also, a certified copy of reissued letters patent of the United States, granted to the Dental Vulcanite Company, for improvement in artificial gums and palates, and dated January 10, 1865, numbered reissue 1848, and the same is marked Complainants' Exhibit F, J. A. S., Exr.

Also, a certified copy of reissued letters patent of the United States, granted to the Dental Vulcanite Company, for improvement in artificial gums and palates, dated March 21, 1865, numbered reissue 1904, and the same is marked Complainants' Exhibit G, J. A. S., Exr.

Also, a certified copy of assignment dated July 17, 1866, from the Dental Vulcanite Company to Josiah Bacon, and the same is marked Complainants' Exhibit H, J. A. S., Exr.

35 Also, certified copy of assignment, dated January 7, 1868, from Josiah Bacon to the Goodyear Dental Vulcanite Company, and the same is marked Complainant's Exhibit I, J. A. S., Ex'r.

Also, an exemplified copy, under the great seal of the State of New York, of the certificate of incorporation of the Goodyear Dental Vulcanite Company, dated December 18, 1867, and the same is marked Complainants' Exhibit J, J. A. S, Ex'r.

Deposition of Isaiah S. Hyatt.

Direct examination by B. F. LEE, Esq., of counsel for complainants:

Question 1. What is your name, age, residence and occupation?

Answer. My name is Isaiah Smith Hyatt; my age, 46; residence, Newark, New Jersey; and my occupation manufacturer of celluloid.

Ques. 2. What is your relation, if any, to the Celluloid Manufacturing Company?

Ans. I am a stockholder and the secretary of the company.

Ques. 3. How long have you been an officer of that company, and state what offices you have held under it?

Ans. I have been an officer for something over five years; and have been vice-president, treasurer, and secretary. I have been secretary all the time since the organization of the company, was treasurer two years I think, and vice-president two years.

Ques. 4. Are you the person named as one of the inventors in the following letters patent: Letters patent of the United States dated July 12, 1870, numbered 105338; letters patent of the United States dated March 28, 1871, numbered 113055; letters patent of the United States dated December 5, 1871, numbered 121522, and letters patent of the United States dated June 23, 1874, and numbered 152232.

Ans. I am.

Ques. 5. Do you not know the fact that the Celluloid Manufacturing Company is defending these suits by counsel employed by them, and is substantially the real defendant in these cases?

Ans. I understand that to be so as to the use of celluloid only.

Ques. 6 Look upon the thing now shown to you, and state by whom it was made, and whether it has any settled commercial name; and if yea, what is such name?

36 Ans. It was made by the Celluloid Manufacturing Company, and its name is celluloid dental plate blank; the word blank is not always used; it is commonly called a celluloid dental plate.

(Said celluloid dental plate offered in evidence and marked Complainants' Exhibit Hyatt No. 1, J. A. S., Ex'r.)

Ques. 7. The words "patented July 12, 1870; March 28, 1871," stamped upon this dental plate, were placed there by the Celluloid Manufacturing Company and refer to the letters patent above named of the same date, do they not?

Ans. They were placed there by the Celluloid Manufacturing Company, and refer to those patents.

Ques. 8. The dentists who are defendants in these proceedings are defended by the Celluloid Manufacturing Company for the reason that they have used things of its manufacture like Exhibit Hyatt No. 1, are they not?

Ans. I presume that is so.

Ques. 9. Don't you know that that is the reason why you have assumed their defence?

Ans. We assume the defence of dentists who are prosecuted for using celluloid plates similar to this exhibit, Hyatt No. 1, and we defend them only in the use of this thing made by us.

Ques. 10. The Celluloid Manufacturing Company issues to dentists using things like Exhibit Hyatt No. 1 printed instructions how to make them into sets of artificial teeth; and what is known in the art as a celluloid set of teeth is made according to such instructions, is it not?

(Objected to as irrelevant, unless it applies within the knowledge of the witness to the way in which these defendants have made celluloid sets of teeth.

Question withdrawn, and repeated with the following words added.)

Ques. 11. Question 10 repeated—Assume that the dentists using the things like Exhibit Hyatt No. 1 effect the moulding thereof and the union of the teeth thereto in the manner described in your three patents, No. 113055, No. 122522 and No. 152232?

(Objection repeated, and further objected to as assuming that the three patents mentioned in the amended question describe the manner of effecting the moulding of the plate and the union of the teeth thereto.)

Question amended by adding to it the words "or any one of them."

Look upon the circular now shown you, and answer the question.

37 (Objected to as incompetent, the patents not being shown to the witness, and it not being shown that he has compared them with the circular, and the circular not having been properly introduced or identified.)

Ans. The Celluloid Manufacturing Company issues to dentists using the celluloid blanks referred to printed instructions as to the proper method of their use in making artificial sets of teeth; and what are known as celluloid sets of artificial teeth are only properly made, so far as I know, by complying with such instructions.

Ques. 12. Is the paper now shown you a paper issued to such dentists by the Celluloid Manufacturing Company?

Ans. It is.

(Paper referred to by the witness offered in evidence, and marked Complainants' Exhibit Hyatt No. 2, J. A. S., Ex'r.)

Ques. 13. Are you not defending these suits because the defendants have made sets of artificial teeth on the celluloid base, as described in Complainants' Exhibit Hyatt No. 2?

(Objected to because it does not appear that the witness knows how these defendants have made sets of artificial teeth on celluloid base, and he has already been asked and has answered why the celluloid company defend these suits.)

Ans. We are defending dentists who are prosecuted for using celluloid in the manufacture of artificial teeth. I don't know that they all follow the instructions contained in Exhibit Hyatt No. 2.

Ques. 14. Do you not know that in making sets of teeth on the celluloid base, in the method described in Complainants' Exhibit Hyatt No. 2, that the dentists very commonly use dry heat or heated air instead of steam as the heating medium?

(Objected to as incompetent, no dry-heat process being described in the Exhibit Hyatt No. 2, and the witness having already stated that the circular describes the method used, so far as he knows, of making the celluloid plates.)

Ans. I do not think or believe that the dentists commonly do use dry air as the heating medium instead of steam; I believe some do.

Ques. 15. Look upon the thing now shown you, and state by what name it is commonly known.

Ans. A celluloid set of artificial teeth—a partial set; that is, a set having some of the teeth omitted.

(Complainants offer the set of teeth referred to and the same is marked Complainants' Exhibit Hyatt No. 3, J. A. S., Ex'r.)

38 Ques. 16. Look upon the thing now shown you, and state by what name it is commonly known.

Ans. I think that it is a set of rubber teeth; it is commonly known as a hard rubber set of artificial teeth.

(Complainants offered the last set of teeth referred to, and the same is marked Complainants' Exhibit Hyatt No. 4, J. A. S., Ex'r.)

Ques. 17. Look upon the thing now shown you, and state by what name it is commonly known.

Ans. That is known by the name of a hard rubber set of teeth.

(Complainants offer in evidence the last-named set of teeth referred to, and the same is marked Complainants' Exhibit Hyatt No. 5, J. A. S., Exr.)

Witness states: Exhibit Hyatt No. 4 is made of celluloid instead of rubber; it is made from one of our bases produced, I should think, three

or four years ago, or at all events before we had succeeded in producing a color similar to Hyatt Exhibit No. 1, many of the celluloid bases made formerly being similar in color to some kinds of red rubber. By examining it as to smell I discovered my mistake.

Ques. 18. Between your answer to question No. 16 and your correction thereof, did you not rub Exhibit No. 4 violently upon cloth, and did you not scratch and cut it with your penknife and then smell it before you put the correction upon the record?

Ans. As soon as the Exhibit No. 5 was placed in my hands, I discovered my mistake at once from noticing the smell of the rubber, and remembering that I discovered no smell in Exhibit No. 4, I immediately said that I had made a mistake, and was sure of it before any scratching or violent rubbing had been done; the difference in appearance between the two exhibits was apparent by a comparison.

(Objected to as irresponsive, and the witness is requested to answer the question.)

Ans. Yes; after I had discovered my mistake.

Ques. 19. Did you not first cut a hole in the rubber base and smell the fresh cut?

Ans. I cut the hole in the rubber plate and smelt it before making the correction.

Subscribed and sworn to before me this 9th day of June, 1876.

I. SMITH HYATT.

38*a* *Complainants' Exhibit Hyatt No. 2.—J. A. S., ex'r.*

CELLULOID MANUFACTURING COMPANY, NEWARK, N. J.

M. Lefferts, pres.; I. Smith Hyatt, v. pres. and sec.; M. C. Lefferts, treas.; John W. Hyatt, supt.

THE CELLULOID BASE.

To the dental profession:

GENTLEMEN: In presenting to you a new circular, descriptive of the celluloid base, we are glad to use the language of distinguished members of your profession instead of our own, in setting forth its merits, and its superior adaptation to the wants of the dental fraternity and of the public. The Missouri Dental Journal of last December contained an article entitled "The Present State of the Celluloid Question," which was written by Dr. H. Judd, and signed by him and by Doctors Isaiah Forbes, Wm. N. Morrison, G. A. Bowman, Wm. H. Eames, C. W. Rivers, and Wm. A. Bartleson. The article was submitted to the St. Louis Dental Society, and endorsed in every particular by a unanimous vote of the society, as attested by Dr. Henry Fisher, secretary, and is there given in full:

"It is well known by the dental profession that during the last ten years much change in opinion has taken place in relation to the propriety of using rubber plates. The more observing members of the dental fraternity had fully satisfied themselves that red rubber was liable to produce serious disease of the mucous membrane of the mouth, when used as a base for artificial teeth, and the more independent of this class have for some years entirely discarded it in their practice. Many, however, resort to the black rubber, which is doubtless much less deleterious in its effect; but its color was objectionable, and when the cel-

luloid was brought to the notice of the profession, it was hoped by nearly all practitioners that it would supersede rubber altogether. Many other bases had been tried in the mean time, and although some of them were useful, there were objections to them which forbid their universal adoption. Celluloid as first introduced was soon classed among those which had failed to answer the purpose of a reliable and lasting base. It was almost universally conceded, however, that it had some properties which were exceedingly desirable in a base plate. It was considerably less liable to break than rubber, and very much more comely in appearance, but for a long time the difficulties encountered in working it were so great that but few succeeded in surmounting them. We, as well as many others, have never quite abandoned the hope that celluloid would finally become practicable, when a whole profession, with the well known energy and perseverance and determination which characterizes our own, had set their hearts upon making it a success. It is well known, however, that as long as celluloid was in such a state of development only as to lead those who used it into difficulty, and to entail upon them serious loss, the profession in this city discouraged the general use of it in practical cases, well knowing that at that time a short experience with it in practice would suffice to convince them that it was as yet worthless for practical purposes. Various improvements were made from time to time by those who were interested in its success, and several times was it announced that all difficulties in working it had been overcome. Careful experiments were each time made in this city, by the most competent of men, making use of the improved material and improved methods of manipulation, but disappointment followed disappointment, until we had nearly despaired of a successful result ever being attained. We are, however, able now to state that the long desired result has finally been attained. We would have been gratified if we had been able to announce that celluloid could now be worked with almost as much certainty as rubber, and with but little more expense and labor, but we are constrained to state that we are fully satisfied from our own experience that it has the advantage of rubber in every particular. In beauty, there is no comparison to be made with rubber; in strength, we are satisfied from experiments that it has the advantage; in close adaptation to the teeth it certainly has the advantage of rubber; in cleanliness and healthfulness it is undoubtedly preferable to rubber. In simulating the color of the gums it exceeds by far anything that has ever been used for that purpose, except porcelain, and, indeed, it imitates the natural gums so closely in appearance that it will seldom, if ever, be necessary to use gum teeth for this kind of work. Next, it can be put up with considerable less labor than rubber, and, all things considered, at a less expense. It is true that the material costs more than rubber for a case of teeth, but take into consideration the fact that plain teeth can be generally used, and the difference of expense in teeth will more than compensate for the difference in favor of rubber in material for the plate, the expense for a whole plate of celluloid now being only sixty cents, and for a partial plate only thirty cents. The whole apparatus, flask and all, cost $15, which covers the whole expense of outlay for one who has instruments and apparatus for working rubber.

"We have made no statement here but which has been fully considered, and we say, without hesitation, that with the same care that is required to succeed with a rubber plate, success with the celluloid is certain. It is true that a little experience is necessary, as the manipulation is a little different from that required in working rubber, but the

printed directions sent with each apparatus will generally suffice to make all plain, if they are carefully observed. There are few persons, however, upon which a little more detailed explanation might be useful. If too great a degree of heat is used whilst pressing the plate, it will come out of the flask porous, just as rather thick masses of rubber will, if they are vulcanized at too great a heat. Plates are mended with the greatest facility by moistening the new piece and the part of the plate to which it is to be attached with a saturated solution of camphor in alcohol. Hold the piece in position a few minutes, and it will adhere sufficiently to retain its place whilst pressing. Its durability has been tested to such an extent that there can be no question but that it is fully as lasting as rubber, and nothing remains to be done so far as the establishment of its entire reliability is concerned. For regulating plates, and indeed in every place where rubber as a valcanite can be used, celluloid may with advantage be substituted for it. As there are no patents which lie in the way of its universal use, we commend it with confidence to the dental profession."

Views similar to the above have been expressed by various State, district and local dental societies in several States; and this, with the fact that the celluloid base has been adopted by a large proportion of the prominent dentists throughout the land, renders it unnecessary for us to add any individual testimonials from the large number in our possession. Celluloid has come to be a necessity in dental practice, which makes it our province to meet this necessity by faithfully producing base plates of the best quality, and by giving to those of the profession who are yet unacquainted with the improved methods of its manipulation all the appropriate information within our knowledge, which, in conjunction with their own professional skill, we believe will fully meet all requirements. Such information will be found on the following page.

We have received numerous letters from members of the dental profession, informing us that Josiah Bacon, or his agents, seek to interfere with the use of celluloid as a base for artificial teeth, by asserting that such use is an infringement of the Cummings patent, and by threats of prosecution against all dentists who use celluloid and refrain from taking out a license from the Goodyear Dental Vulcanite Company.

We caution the profession against being intimidated or deceived by such statements. The use of celluloid is not an infringement of the Cummings patent; and we are ready to protect all dentists in the use of celluloid against any suit brought against them on account of such use.

PRICES.

Full plate, upper or lower	$0 60
Partial plate	30
Plumper plate	1 00
Apparatus complete (steam)	15 00
" " (improved oil)	10 00
Flask	1 50
Thermometer for oil apparatus	1 00

We have assigned to Dr. S. S. White the exclusive right to sell the celluloid base under all our American patents. All orders from the trade or profession should be addressed accordingly.

CELLULOID MANUFACTURING CO.

NEWARK, N. J., *October*, 1875.

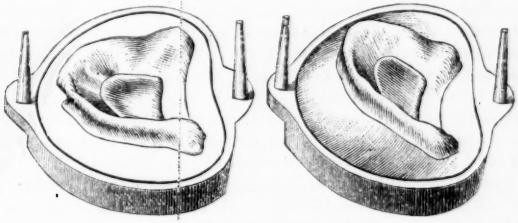
38*b* INSTRUCTIONS.

In the process of making artificial dentures with the celluloid base, the teeth, whether plain or in blocks, are arranged on a base plate of wax or gutta percha, and invested in the flask, with the best quality of plaster, in the manner usual where rubber is used—except that the trial plate should be much thinner, because celluloid is much stronger than rubber.

The position of the model in the flask should be such as will allow the flask to come together with the least liability of breaking down the alveolar ridge. The following quotation of an article by Prof. Wildman, published in the Dental Cosmos of March last, illustrates a class of cases that frequently occur, and tells how to manage them successfully:

"Having recently had my first failure in a celluloid case on account of the plaster model breaking down in bringing the sections of the flask together, I will relate how this occurred, and the method used to overcome this difficulty, hoping it may be of some benefit to my professional brethren who may have a similar case.

FIG. 1. FIG. 2.



"The cut No. 1 represents the undersection of the flask containing the model of the part of the gums upon which the denture rests, and placed in the usual position. The alveolar ridge is projecting in three-fourths of its extent, and particularly so and quite thin on the anterior portion, extending back as far as the space formerly occupied by the canine teeth. This portion of the alveolar ridge, when a perpendicular force is brought to bear upon it (such as is exerted in bringing the sections together), has no base of support, and has to depend for its integrity of shape upon the strength of a thin section of plaster. In this case, although great care was exercised in bringing the sections of the flask together, the anterior projecting edge of the alveolar ridge chipped off and produced an annoying failure. The next move was to make an exact counterpart of the model of the gums in type-metal by the aid of Hawes' flask. To test the propriety of using this metal model upon which to mould the celluloid base to, it was accurately fitted, while in a plastic condition, a thick plate of prepared gutta percha (such as is used for base-plates for model sets); this, when hard, was so firmly retained by the under-cut as to show the impracticability of using it for the purpose designed. The model was then carefully examined to ascertain*ed* what means could be devised to obviate the cause of failure, which I admit should have been done in the first instance. A little reflection upon the effect of the required force upon the model gave the idea. I then fell back upon the plaster model, which was placed in the lower section of the flask in position as represented in cut No. 2, so that the perpendicular line of force

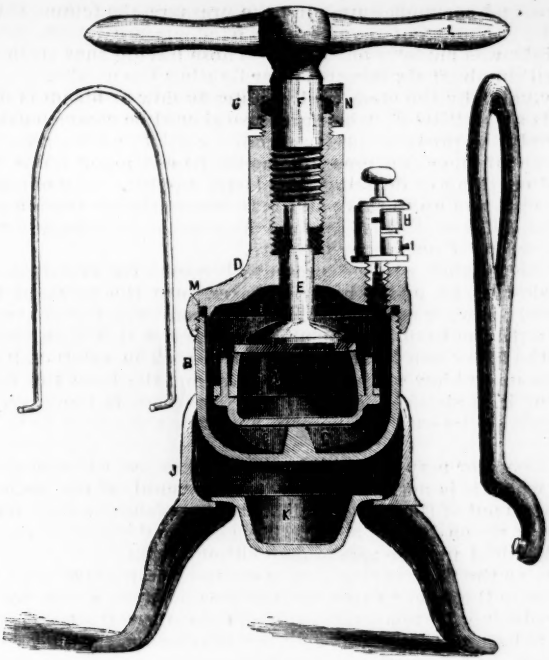
(or pressure) in bringing the sections of the flask together would pass almost wholly through the mass of plaster supporting the projection. The result was, the case was moulded without any injury to the plaster model, and was a perfect success."

The hardness of the plaster may be increased in various well-known ways, but this is unnecessary, because good plaster makes a cast amply hard for moulding celluloid as the moulding ought to be done, from the fact that the care required to avoid injuring the plaster mould compels the operator to apply pressure slowly, and in doing so the pressure is communicated to the celluloid at a rate no faster than that required to produce the best and most permanent results, for reasons that will hereafter appear.

Around the outside of the teeth, about one-fourth of an inch away, bevel the plaster back to the flask to receive the excess of material. Do not cut gateways leading to the beveled gutter; but leave the surrounding margin of one-fourth of an inch to act as a back pressure on the celluloid during the moulding process, so that every part within the mould and around the teeth and pins will be well and firmly filled, and a perfect adaptation of the celluloid to the teeth and the mould be secured.

When the flask is thus prepared, select a plate of sufficient size not only to fill the mould, but to overflow in all directions. This must be done to secure back or lateral pressure from the mould that the adaptation of the celluloid may be perfect, and the pressure uniform and thorough in all parts. If the plate selected does not approximate the shape of the mould, heat it in boiling water and bend or trim it to the proper shape. The plate should not be wider than the mould, as in that case it would be likely to fold in the centre or around the air-chamber; and as the fold would not weld together, a crack or weak place would remain. A plate should therefore be selected to fairly fit the mould, with a tendency to flow from the centre outwards during the moulding process.

MOULDING IN STEAM.—The accompanying cut illustrates our steam apparatus, by a view through a central vertical plane.



A, represents the flask; B, the boiler; C, the radial ribs to support the flask; D, the cover to the boiler E, the plunger in contact with the flask; F, the screw for forcing the plunger upon and closing the flask; G, gland for packing the screw F, to prevent the escape of steam; H, the upper section, and I, the lower section of the safety-valve; J, the heater; K, cup to contain alcohol for generating steam, which may be removed if it is desired to use gas; L, handle; M, rubber steam packing ring; N, hemp or other steam packing. The apparatus should be kept neat and clean; it should be washed out and dried after each use to prevent rusting, and the screw F, and top of the plunger E, oiled.

In moulding in steam, after preparing the flask and plate as above described, first pour enough water into the steam chamber to just cover the radial ribs in its bottom, and place the flask containing the plate and teeth in the steam chamber. Retract the screw in the cover of the steam chamber till the plunger can be lifted against the top to prevent it from pressing on the flask while screwing on the cover; and screw the cover down snugly to make it steam-tight. Then fill the cup in the bottom of the heater with alcohol and ignite it, or light the gas if that be used, setting the steam chamber properly in the heater. As soon as the gas or alcohol is lighted, suspend the upper section of the safety-valve weight, by placing its projecting pins in the slots provided for them in the shell. Then without touching the valve, wait till the pressure of steam blows off under the half-weight. When this occurs detach the upper weight from the slots so that both sections are sustained by the

valve-stem, and commence applying the pressure, the temperature being about 270°. In our first manufacture of steam apparatus, the safety-valve weight was made in one piece. Those having that style of valve should, within about six minutes after lighting the alcohol or gas, raise the safety-valve by the stem, and if a steady flow of steam is observed, the heat is about 270° F., when pressure should be commenced.

Now apply the pressure pretty rapidly, until the resistance becomes so great that if the rapid pressure should be continued there would be danger of crushing or defacing the plaster moulds. The object of hastening the process up to this point is to secure the pressure upon every part of the celluloid plate before the heat becomes sufficient to render the plate porous if not under pressure.

When the resistance to the pressure becomes considerable, follow it up more slowly, and as the heat increases, turn the screw at intervals as the slowly flowing celluloid will permit, continuing thus at a decreasing rate, until the flask is completely together, which it is obvious will be when the screw can be turned no farther. The safety-valve will allow the steam to blow off, generally, at about the time the flask is together, but if it should blow off before the flask is together, no harm would result as the safety-valve will not permit the heat to become too great.

A new operator may, through lack of experience, suppose the flask is together when it is not. This will be discovered, of course, when the flask is taken out of the boiler. In such case, place the flask back again and heat it up as before, adding the necessary pressure to close the flask. Celluloid may be remoulded without harm.

As soon as the flask is closed turn off the gas or extinguish the alcohol, and raise the safety valve for the escape of the steam for the purpose of reducing the temperature, and then allow the boiler, flask and contents to become thoroughly cold before relieving the flask from pressure; but do not hasten the cooling process.

These directions comply with the nature of celluloid and the principles by which it must be manipulated to secure the best results. Its nature under the influence of heat, is to be reduced to a plasticity of a somewhat tenacious quality, so that its form must be changed slowly while being moulded, or it will not retain its strength or toughness, but will either be crushed or torn apart, or partially disintegrated. It must be brought under the pressure of the moulds in all parts as soon as the heat renders it sufficiently soft for that purpose, and kept under continually increasing pressure while being heated; otherwise it will become porous or cellular. At the last stage of the moulding process the heat must be sufficient to soften the material to the greatest practicable extent short of over-heating, so that all tendency of the particles to crawl back or return towards the previous shape will be overcome, and at the same time, that is during the last stages of moulding, the pressure must be applied very slowly, the screw being turned very slightly, and at intervals, so that the particles will move gradually and naturally into position, coming into a state of rest with respect to each other, and free from tension towards a change of form. The material must then be allowed to cool slowly, that its particles may have time to flow into a state of equilibrium or rest under the last pressure before being chilled. Now, when a celluloid plate is moulded as above directed, and in accordance with the principles just explained, it will not become porous, neither will it warp or change form, or be faulty in any particular.

OIL OR GLYCERINE.—These principles and rules must be observed in

moulding a plate in the oil apparatus as well as the steam; the only difference being that, in the oil apparatus the heating medium employed is oil, glycerine, parafine, or any suitable liquid the boiling temperature of which is not less than 300° F., the operator observing the temperature by means of a thermometer instead of a safety-valve.

In moulding a plate in the oil apparatus, commence applying the pressure when the thermometer indicates 270° F., from which time till the flask is brought together the same rate and rule of pressure is applied as already described for moulding a plate in steam. The flask should be closed at about 300° F., above which the heat should not be permitted to rise. If the flask is not quite together at that degree, do not hurry the pressure, but turn down the gas or lamp flame so that the heat will not be further increased, and proceed deliberately with the pressure. When the flask is together, extinguish the flame, so as to lower the temperature and prevent over-heating, and let the flask and contents remain under pressure till cold.

When thoroughly cold, the flask may be opened, and the case freed from plaster and finished up in the usual way.

After finishing the case ready for the mouth, keep it in water till the patient calls for it; and then instruct the patient to keep the plate in water when not wearing it. The patient should also be instructed to thoroughly cleanse the plate morning and evening, (and still better, after each meal,) by means of brush and soap and water.

When the case is taken out of the flask, if the plaster model should be broken, a new cast should be taken from the palatine side of the plate, and marked with the patient's name and the date of the work, and preserve for a possible future use, as follows: If the plate should subsequently change form from any cause, such as too rapid moulding, or too sudden cooling, or from the blank form from which the plate is made, being insufficiently seasoned, or from the patient getting it out of shape by cleansing it in too hot water; the difficulty may be remedied in a few minutes by taking the preserved model and re-fitting the plate thereto by softening it in hot water and pressing it with the fingers upon the model and cooling it there. If this is done carefully and thoroughly, the fit will be perfect and permanent. In this operation the teeth must not be touched while the plate is hot and soft, or they may be loosened or pushed out of place.

These instructions are explicit and complete; and if they are intelligently and faithfully followed, success will be certain in every instance.

CAUTION.—In the steam apparatus the wooden handle is of the proper length and should never be replaced by a longer one. With the present length, there is no danger of applying sufficient force to break the machine; but with more leverage and a reckless application of "muscle," damage might result.

REPAIRING.—A break may be mended so as to be as strong as new by using a strong solution of camphor in alcohol, and partially dissolving the surfaces to be united, and clamping and tying them together, and letting them remain several hours to become thoroughly dry and hard; or new teeth may be added by waxing the new teeth in their desired position in the old plate, investing the case in the flask, and cementing on to the old plate a piece of celluloid of sufficient size, and so located that it will flow into and fill the place vacated by the wax, and then remoulding the case.

CELLULOID MANUFACTURING CO.

39 *Deposition of Charles T. Warner.*

Direct examination by EDWARD N. DICKERSON, Esq.:

CHARLES T. WARNER, witness called on behalf of complainants, being duly sworn, testified as follows:

Question 1. What is your name, age, residence, and occupation?

Answer. My name is Charles T. Warner. My age, 43 years; residence, New Brunswick, New Jersey; and occupation, superintendent of the Novelty Rubber Company.

Ques. 2. How long have you been engaged in the manufacture of india rubber goods; and state your experience in such manufacture?

Ans. I have been engaged in the manufacture of india rubber goods since 1849. I have been engaged in the manufacture of hard rubber since 1863.

Ques. 3. What classes of goods does the Novelty Rubber Company manufacture?

Ans. Buttons, pipes, smokers' articles, match boxes, jewelry ornaments, chains, and various small articles; all of hard rubber.

Ques. 4. Explain to the court the process by which an ornamented button of hard rubber is manufactured.

Ans. The rubber is made one part sulphur, two parts of rubber, made into the proper thickness in a sheet by means of a calender; it is then placed between sheets of tin, put into the vulcanizer and prepared for hardening; its condition then is a sheet of hard rubber. It is then cut in blanks the size that the button is required to be; it is soft; then placed in heated dies, put under a screw or other press, and pressed to the form of the mould or die; it is allowed to remain in the die until cold; it will then retain the shape of the die or mould, be what it may. The button now produced by me was made in our factory in the manner described.

(Button offered in evidence, and same is marked Complainants' Exhibit Warner No. 1, J. A. S., Ex'r.)

Ques. 5. Do you practice any other method of moulding articles out of hard rubber; if so, describe that?

Ans. We make ornaments for jewelry in dies or moulds; the manner of making is different in some particulars from that of making buttons; we put the rubber into dies or moulds, in the soft state; we first warm the dies sufficient to soften the rubber; it is then put in clamps, pressed into the mould, put into the heater, and afterwards allowed to harden. It retains the shape of the mould or die when hard.

40 Ques. 6. Explain and describe the effect produced upon the compound by the process of vulcanization, so that the court may understand what is the condition of the material during the operation.

Ans. The condition of the material is soft when the heat is applied; it remains soft during the process of vulcanization; that is, while heat is being applied. When cold it is hard, like horn or whalebone. It can be softened again by heat, and pressed into various forms or shapes.

Ques. 7. Have you ever worked celluloid in your factory into buttons or other forms? If so, state the process.

Ans. We have made it into buttons; the process of making is the same as that of making rubber buttons.

Ques. 8. Where did you get the celluloid for the purpose of making those buttons?

Ans. It was sent to us by the Celluloid Manufacturing Company of Newark, New Jersey.

Cross-examined by Mr. BALDWIN:

Cross-ques. 9. Can you produce one of these rubber button blanks that you have mentioned?

Ans. I haven't one here, but I will send out to get a rubber button from the shop, out of which I will make a blank.

Cross-ques. 10. Are they flat, the blanks?

Ans. They are, a flat disk of hard rubber, just like a gun wad.

Cross-ques. 11. You say the rubber is made one part sulphur, two parts rubber; what regulates that proportion between the ingredients of the compound?

Ans. Hard rubber is produced by an excess of sulphur and heat; its proportions may be varied; for general purposes, one of sulphur and two of rubber is considered the best compound.

Cross-question 12. Within what limits may the proportions be varied and the product be hard rubber after vulcanization?

Ans. That is difficult to say; there might be a quarter of a pound of sulphur to three-quarters of a pound of rubber, or there might be three-quarters of a pound of sulphur to a quarter of a pound of rubber.

Cross-ques. 13. What is the least proportion of sulphur that you have known to produce hard rubber?

Ans. Twenty-five per cent. of sulphur.

41 Cross-ques. 14. You say that after the sheet is calendered to the proper thickness, placed between sheets of tin, put into the vulcanizer, and prepared for hardening, "its condition then is a sheet of hard rubber"; this is not what you mean, is it?

Ans. I mean to say that after it is heated, taken out, and cooled.

Cross-ques. 15. When put into the vulcanizer it is not hard, is it?

Ans. It is not.

Cross-ques. 16. How is the rubber and the sulphur mixed and prepared for putting into the vulcanizer?

Ans. It is mixed in what is known as a grinding mill; the rubber is passed through the mill until it is quite soft; the sulphur is then incorporated by passing it through the mill.

Cross-ques. 17. In its soft state the rubber and the sulphur are only mechanically mixed, are they not?

Ans. That is all.

Cross ques. 18. What do you call this mixture when it is in this condition?

Ans. We call it mixed rubber.

Cross-ques. 19. You only call it hard rubber after it has been vulcanized, do you?

Ans. Yes.

Cross-ques. 20. What is the difference between mixed rubber and hard rubber, so far as you know?

Ans. One is mixed rubber and not hard, the other mixed and hard.

Cross ques. 21. Is the mixed and hard rubber merely mechanically mixed, or does the vulcanization effect some change in it, and what, so far as you know?

Ans. It makes a change from a soft substance to a hard one; that is, it is soft when constantly heated, but hardens when allowed to cool.

Cross-ques. 22. Does vulcanization make a change from a mechanical mixture to a homogenious compound, and effect a conversion of the mixture?

Ans. There is a chemical change takes place during vulcanization.

Cross-ques. 23. Do you know any vulcanizing agent which affects this change in mixed rubber, except sulphur?

Ans. Iodine is said to produce a similar effect to sulphur.

Cross-ques. 24. Do you know any substance except rubber upon which sulphur and heat produce this conversion?

42 Ans. It will produce the same effect on gutta-percha when properly treated; and on linseed oil and on vegetable oils, although it will not make hard rubber out of them.

Cross-ques. 25. How long does it take to convert the mixed rubber into hard rubber by the vulcanizing process?

Ans. That depends somewhat on the degree of heat applied; from four to twelve hours.

Cross ques. 26. Does the time vary; and, if yea, how, with the proportion of sulphur?

Ans. It does; it requires a longer time to vulcanize thick sheets than thin sheets of rubber, the proportions of rubber and sulphur being the same; the smaller the amount of sulphur the longer time it takes to vulcanize it.

Cross-ques. 27. What degree of heat does it require?

Ans. We use from 300° to 310° Fahrenheit.

Cross ques. 28. Does it require the same heat with the smaller proportion of sulphur you have mentioned?

Ans. The duration of the heat should vary with the amount of sulphur; the less sulphur the longer the heat must be continued, but at the same rate temperature.

Cross ques. 29. You say the process of making buttons of celluloid is the same as that of making rubber buttons; state how far it is the same.

Ans. The celluloid buttons that we made were made in the same manner that we make rubber buttons; that is, the celluloid is cut into round blanks or disks, and heated and pressed in moulds or dies.

Cross-ques. 30. Did you ever press in moulds or dies horn buttons?

Ans. I never have.

Cross-ques. 31. Do you know how it is done?

Ans. It is done the same as rubber, by means of heat and pressure.

Cross ques. 32. How and when is the eye or shank put in these rubber buttons, like Exhibit Warner No. 1?

Ans. It is put in before the button is pressed; after vulcanization there are two holes drilled in the blank in which the eye or shank is set sufficiently deep to hold it while pressing.

Redirect by Mr. DICKERSON:

Ques. 33. How would you convert the button Exhibit Warner No. 1 into a blank if you were required to do so?

43 Ans. By means of heat, by putting it on a hot plate of iron for instance.

Ques. 34. Explain to the court what would happen to that button if it were laid on a hot metallic plate.

Ans. Instead of having the form it now has it would become a flat disk, which was its original condition.

Ques. 35. How long have you been acquainted with the process of moulding hard rubber in any desired form?

Ans. I have had a practical knowledge of it for thirteen years, and a general knowledge since the Goodyear hard rubber patent was granted.

Recross examination:

Cross Ques. 36. During all this time since the Goodyear patent was granted it was common to use moulds or dies to give the article the required form, was it?

Ans. I think it was.

Subscribed and sworn to before me this 9th day of June, 1876.
CHAS. T. WARNER.

Deposition of Josiah Bacon.

JOSIAH BACON, a witness called on behalf of complainants, being duly sworn, testifies as follows:

Direct examination by B. F. LEE, Esq.:

Question 1. What is your name, age, residence and occupation?

Answer. My name is Josiah Bacon, my age 44 years, residence Boston, Massachusetts, and my occupation treasurer and manager of the Goodyear Dental Vulcanite Company.

Ques. 2. As such manager is it part of your business to become familiar with the methods practised by dentists in making sets of artificial teeth?

Ans. It is.

Ques. 3. How long have you been so familiar with such methods?

Ans. Ever since my connection with the company since its organization in 1866, and for two years previously with the corporation, its predecessor, the owner of the patent.

Ques. 4. Will you produce a flask with the teeth inserted therein with plaster in the manner usual where rubber is used, and offer the same as an exhibit?

44 Ans. I will, and now produce it.

(Flask and contents offered in evidence by complainants' counsel, and the same is marked Complainants' Exhibit Bacon No. 1, J. A. S., Ex'r.)

The teeth, it will be observed, are slightly loose in the plaster, and have become so from frequent use in illustrating.

Ques. 5. Will you produce a piece of the vulcanizable compound of rubber and sulphur, and state what has to be done in order to fill the plaster mould within the flask with the vulcanizable compound, and to make the set of teeth?

Ans. I produce such piece of vulcanizable compound.

(The same is offered in evidence by complainants' counsel, and the same is marked Complainants' Exhibit Bacon No. 2, J. A. S., Ex'r.)

This piece of rubber is held in boiling water for a few moments, when it will become quite soft and plastic; then the flask with its plaster contents having been heated about as hot as it can well be handled, is opened, and the sheet of plastic material or rubber is placed between the two parts of the flask; the flask is then closed and placed in a vice, and pressure gradually applied by screwing up the vice until the flask is brought together; the flask is then placed in an oven or vulcanizer and heated to about 300 degrees. After remaining a sufficient time it is removed and allowed to cool gradually, and harden; care being taken that the plate should be perfectly cool before it is taken out of the flask.

Ques. 6. Do you know how plates for artificial teeth are made from the precious metals; and, if yea, please state how they are formed into shape?

Ans. A die and counter die, sometimes called a male and female die, are made from the plaster casts of the mouth, and between these two dies, the sheet of metal to be used is placed, and with sufficient blows of a hammer (usually of about five pounds weight) it is swedged into shape and fit. I produce a die and counter die such as I have alluded to.

(The same are offered in evidence by complainants' counsel, and the die is marked Complainants' Exhibit Bacon No. 3, the counter die being marked Complainants' Exhibit Bacon No. 4, J. A. S., Ex'r.)

Ques. 7. Will you produce a set of teeth made in the manner referred to in your last answer?

Ans. I will, and now produce them.

45 (Set of teeth offered in evidence by complainants' counsel, and the same is marked Complainants' Exhibit Bacon No. 5, J. A. S., Ex'r.)

Ques. 8. How are the teeth fastened to the plate in Exhibit Bacon No. 5?

Ans. By solder and rivets.

Ques. 9. Do you know any particular reason which would be likely to induce Dr. Judd and his associates to give up vulcanite, and take up celluloid, and recommend others to do likewise, as they do on the first page of Exhibit Hyatt No. 2?

(Objected to as incompetent and irrelevant.)

Ans. I do; as the parties there, I believe without exception, are under injunction from the court, forbidding their use of rubber.

Cross-examined by Mr. BALDWIN:

Cross ques. 10. When this piece of rubber, Exhibit Bacon No. 2, has been softened in boiling water, how is it placed between the two parts of the flask?

Ans. It is placed with the fingers between the two parts; the flask being taken apart to permit the same.

Cross-ques. 11. Is it laid flat between the two halves of the flask?

Ans. No, sir; it is crowded in with the fingers, and as far as possible made to sink into all the depressions.

Cross-ques. 12. If there is more than enough (in the sheet, like Exhibit Bacon No. 2) to fill the mould, is the surplus removed, and how?

Ans. It is allowed to escape through the joint of the flask, in screwing it together.

Cross-ques. 13. When the flask has been screwed together as you have described, is the surplus cut off from the body of the material in the mould?

Ans. It is cut off by bringing the flask together; but yet there will be a rough edge left, which is trimmed off smooth, after the plate which has been vulcanized is taken from the flask.

Cross-ques. 14. In the vulcanizer how is the heat communicated to the flask and its contents; is it a close vessel and steam heat, or dry heat?

Ans. It is a close vessel and steam heat.

Subscribed and sworn to before me this 9th day of June, 1876.

JOSIAH BACON.

46 Complainants offer in evidence certified copy letters-patent of the United States, granted to John W. Hyatt, jr., and Isaiah S. Hyatt, for improvement in treating and moulding pyroxyline, dated July 12, 1870, and numbered 105,338, and the same is marked Complainants' Exhibit K, J. A. S., Ex'r.

Also certified copy letters-patent of the United States granted to John W. Hyatt, jr., and Isaiah Smith Hyatt, assignors to Albany Dental Plate Company, for improvement in apparatus for moulding dental plates, dated December 5, 1871, numbered 120,522, and the same is marked Complainants' Exhibit L, J. A. S., Ex'r.

Also certified copy letters-patent of the United States granted to I

Smith Hyatt and John W. Hyatt, assignors to the Celluloid Manufacturing Company, for "improvement in apparatus and processes for moulding celluloid and the compounds of pyroxyline," dated June 23, 1874, number 152,232, and the same is marked Complainants' Exhibit M, J. A. S., Ex'r.

Counsel for defendants by consent now offers in evidence certified copy of letters-patent granted to Isaiah Smith Hyatt, John Wesley Hyatt, jr., and Jesse A. Perkins, assignors to Albany Dental Plate Company, for improvement in dental plates from pyroxyline, dated March 28, 1871, and numbered 113,055, and the same is marked Defendants' Exhibit No. 1, J. A. S., Ex'r.

This exhibit is offered in evidence out of order for the convenience of complainants and is to be printed as part of the defendants' proofs.

Adjourned to June 10, 1876, at 10 a. m.

Deposition of Henry B. Renwick.

NEW YORK, *June* 10, 1876—11 a. m.

Present, of counsel for complainants, B. F. Lee and Edward N. Dickerson, esqs., and Hon. William D. Shipman, Henry Baldwin, jr., and E. Luther Hamilton, esqs., for defendants.

HENRY B. RENWICK, a witness called on behalf of complainants, being duly sworn, testifies as follows:

Examined by Mr. B. F. LEE:

Ques. 1. What is your name, age, residence and occupation?

Ans. My name is Henry B. Renwick; my age 58 years; I reside in the city of New York; my principal occupation at present is the
47 examination of machinery and processes in the arts; and I am frequently called as expert in the circuit court of the United States, in various circuits, in suits in which patents are in question.

Ques. 2. Have you examined the reissued letters patent No. 1904, granted to the Dental Vulcanite Company, assignee of John A. Cummings, dated March 21, 1865, for improvement in artificial gums and palates, and do you understand the invention therein described? And if yea, please state what you find to be the invention embraced therein.

ANS. I have frequently read and examined the reissued letters patent No. 1904, granted to the Dental Vulcanite Company, dated March 21st, 1865, and I thoroughly understand the same and the invention described therein. The invention, as claimed, may be described as a new article of manufacture, consisting of a plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth, with teeth or teeth and gums secured thereto in the manner described in the patent, the whole making what is sometimes called a case, or, in ordinary language, a set of artificial teeth. The manner described in the patent of securing the teeth to the plate is by imbedding the teeth and pins in the plate while the substance of which it is composed is in a soft or plastic condition, so that when the material composing the plate becomes hard, the teeth are firmly secured by being imbedded, with their pins, in the substance composing the plate, so that there is a tight joint between the plate and the teeth, the whole forming substantially one piece. The material composing the plate must, when hardened, be an elastic material, possessing and retaining in use sufficient strength and rigidity for the purpose of mastication, and at the same time being elastic enough to yield a little to the motions of the mouth. It may be said here, as further illustrating

my idea of what the invention is, that it does not consist in the mere application of vulcanite, or a substance possessing the same characteristics, for the required purpose in place of metal. For instance, if a plate of vulcanite were formed into proper shape, and the teeth were then riveted to it, as they have been to a metal plate, then the completed article, with the teeth riveted to the vulcanite would not be the new article of manufacture described in the Cummings patent.

Ques. 3. State how the sets of teeth described in the Cummings patent, reissue 1904, differ from the dental plates made of the precious metals.

48 Ans. Laying out of view the attempts to cast whole underacts of pure tin by George A. Hawes and William A. Royce, and the attempts made to use unvulcanized gutta percha, which as I understand were unsuccessful and impracticable, the only sets of teeth in practically successful use were made by striking up thin sheets of gold, silver, or platinum between a die and counter die, and then soldering the teeth to the plate by means of small platinum pins attached to the teeth. The die and counter die were formed by taking a wax or plaster impression of the part of the mouth proposed to be fitted by the finished plate. From that impression a plaster cast was taken, which was an exact model of the mouth. From this model a mould in sand was made, into which was cast a hard metal, zinc being generally used for the purpose. This formed the die which was thus a reproduction of the plaster model. A counter die of lead was then cast fitting the face of the zinc die; the sheet of metal was then stamped into shape, by repeated blows of a hammer, between the die and counter die. The high temperature which platinum will bear without melting enabled the dentist to apply to sets of teeth when mounted on a platinum base a sort of porcelain paste, which was applied to the teeth and metal plate, and afterwards baked into porcelain, the gums being formed of this paste, which was converted into porcelain by the baking. These were known as continuous gum sets of teeth. As I understand, however, owing to the great expense of such sets of teeth and their great weight, but few of them were used. A plate constructed on Cummings' system possesses qualities which clearly distinguish it from all the sets of teeth preceding it. In the first place it fits better, as the dentist is enabled to form the plate upon the original plaster cast of the mouth, thus dispensing with the difficult and inaccurate process of constructing dies and counter dies, and stamping the plate up between them. The result is necessarily an accuracy of fit not to be attained by the old method. In the second place, there is a much tighter joint (I may say a perfect joint) between the teeth and the plate than is found in the old plates where the porcelain teeth are riveted and soldered to a metal plate, and thus cleanliness and purity are attained by the use of the Cummings plate, owing to the absence of crevices between the teeth and plate into which, when they exist, fluids from the mouth are apt to enter and decompose. In the third place, the teeth, when imbedded in an elastic material, possessing and retaining in use sufficient rigidity and strength for the purpose of mastica-

49 tion, and at the same time elastic enough to yield a little to the motion of the mouth, are capable of yielding, when subjected to the pressure of the opposing jaw, about as much as the natural teeth yield in their sockets, thus avoiding the shock that would result from the teeth being rigidly held by a hard, non-elastic material.

Ques. 4. Have you read and do you understand complainants' Exhibit Hyatt No. 2, and the manufacture described therein; and also letters patent of the United States granted to I. Smith Hyatt and others,

assignors to the Albany Dental Plate Company, dated March 28, 1871, No. 113055, and the manufacture described therein; and also letters patent of the United States No. 121522, dated December 5, 1871; and the letters patent of the United States No. 152232, dated June 23, 1874, and the process and mechanism described in said last two mentioned letters patent, assuming that the apparatus described in patent No. 152232 is used for moulding the plate and causing the union between the plate and the teeth, as described in said letters patent No. 113055? And state whether the manufacture described in said Exhibit Hyatt No. 2 or in said letters patent No. 113055, when the teeth are united to the plate, by the method of causing the union between the plate and the teeth, described in said several letters patent, or either of them, resembles or differs from the thing embraced in Cummings' reissue No. 1904; and examine also complainants' Exhibit Hyatt No. 3, and complainants' Exhibit Hyatt No. 4, and compare them with what is embraced in said reissue No. 1904.

Ans. I understand that the sets of teeth, Hyatt No. 3 and Hyatt No. 4, are made of a kind of solid collodion now called celluloid and mineral teeth, and that they are made in either one or the other of the apparatus described in letters patent 152232, or letters patent No. 121522, substantially in the manner and of the materials which are described in the patent 113055. I have read all the patents and the circular referred to in the question and believe that I understand them.

I do not consider that Cummings' invention is dependant upon the chemical composition of the plate, any more than it depends upon the chemical composition of the artificial teeth. It is only necessary, in order to apply his invention, that teeth should be used possessing substantially the physical characteristics of artificial teeth, and that they should be imbedded in a plate possessing substantially the characteristics
50 of a vulcanite plate for the purpose for which it is to be used.

The physical characteristics of the substance which forms the plate, in order to fit it for holding artificial teeth, in substantially the manner described in Cummings' patent are, first, capability of being formed or moulded around the roots of the teeth and pins while in a soft and plastic condition; and second, strength and elasticity when cold and hard, such as is possessed by whalebone, ivory, vulcanite, and solid collodion, so that it shall be sufficiently strong and rigid for the purpose of mastication and at the same time elastic enough to yield slightly to the pressure of the jaw. The process described in the patents referred to in the question, as being practiced with celluloid and teeth, must necessarily result in an article of manufacture containing all the features that constitute, as before stated, the distinguishing characteristics of the vulcanite dental plate. I have examined many vulcanite dental plates, and a considerable number of solid collodion or "celluloid" dental plates, and after looking at and handling them, was unable to decide which were vulcanite and which celluloid; in fact I picked out, in several instances, celluloid as vulcanite, and vulcanite as celluloid. I then compared those composed of the one material with those composed of the other, and could distinguish no difference in their physical characteristics except in their odor, and in the slight translucency possessed by solid collodion or celluloid, not deeply colored. The celluloid dental plate, made as referred to in the question, is in my opinion substantially the article of manufacture described and claimed in the Cummings reissue. The celluloid and the vulcanite plates both have the teeth supported by imbedding; both have a close joint between the teeth and the substance which supports them; both have sufficient strength, rigidity,

and elasticity; both of them, as I am informed and believe, are unaffected by the fluids of the mouth, and usual foods and condiments; and both of them, by reason of being manufactured by moulding and pressure, without use of metal dies, and therefore without danger of alteration of such dies during stamping, are almost if not quite exact fits to the mouth and alveolar ridge. I am also informed that users cannot distinguish when in use sets of teeth made of vulcanite from those made of celluloid. I am of the opinion previously expressed as to the substantial identity of the two articles, although I know that celluloid is a different chemical compound from vulcanite, because I believe that the substantial resemblance must be sought in those points or characteristics which are brought into play in actual use, and not in character-
51 istics which are unimportant in such use. In further support of this opinion, I state that solid collodion was described before the date of the Cummings reissue as a substance which might be used in many manufactures where vulcanite had been used, and that I have seen it myself (although I cannot state that it was before the date of the Cummings patent) used for knife handles and cheap jewelry, as vulcanite was and is used. I further state that solid collodion, prior to the date of the Cummings patent, was obtained by evaporating out the solvent, and that such solvents were liquid solvents, such as ether; and that I have examined patents dated before the date of the Cummings patent which describe the mixture of camphor and other gums with collodion.

Ques. 5. Do you understand that celluloid is compounded with sulphur, rubber, etc., in the way sulphur and rubber are usually compounded, or is subjected to heat to harden it?

Ans. I do not understand that celluloid is compounded with sulphur, or has any sulphur in it; I understand that celluloid is subjected to heat while in moulds to soften it, and make it fit the teeth perfectly by pressure, as the vulcanizable compound is, and that celluloid is hard when cold, hardening during the cooling. A vulcanizable compound becomes of a tarry consistency while subjected to heat in the mould, and is hard when cold, after being subjected to the heat, but I do not know when it commences to harden, whether during the cooling or while at the highest heat; although I do know that the final hardening takes place during the cooling.

Adjourned to Monday, June 12, 1876, at 11 a. m.

NEW YORK, *June* 12, 1876—11 a. m.

Present, B. F. Lee, esq., of counsel for complainants, who states that he has received a telegram from Henry Baldwin, jr., esq., stating that he cannot leave his home in Philadelphia to-day, on account of serious illness in his family, and that he will advise further as to whether he can attend on Tuesday; and thereupon this examination is adjourned to Tuesday, June 13, 1876, at 11 a. m.

NEW YORK, *June* 13, 1876—11 a. m.

Present, B. F. Lee, esq., of counsel for complainants, and E. Luther Hamilton, esq., of counsel for defendants, and Mr. Henry B. Renwick for cross-examination.

52 Mr. Lee reads a telegram from Henry Baldwin, jr., esq., stating that he is still unable to leave home; thereupon it was agreed between counsel for the respective parties that the time for taking testimony, which still remains, shall be divided as follows: the defendants to take their evidence in defence between June 13, 1876, and August 5,

1876; the complainants to take their evidence in reply between August 5 and September 5, 1876; the defendants to be allowed to cross-examine Mr. H. B. Renwick, during the time for taking testimony for the defence.

Adjourned to Wednesday, June 14, 1876, at 11 o'clock a. m.

NEW YORK, *June* 14, 1876—11 a. m.

Present, B. F. Lee, esq., of counsel for complainants, and adjourned to Monday, June 19, 1876, at 11 o'clock a. m.

NEW YORK, *June* 19, 1876—11 a. m.

Present, B. F. Lee, esq., of counsel for com plainants.

Adjourned to Tuesday, June 20, 1876, at 11 o'clock a. m.

NEW YORK, *June* 20, 1876—11 a. m.

Present, B. F. Lee, esq., of counsel for complainants, and the witness, Henry B. Renwick, for the purpose of cross-examination.

Mr. Lee produces a copy of a telegram sent to Mr. Baldwin on June 17, 1876, as follows:

"New York, June 17, 1876. To Henry Baldwin, jr., 217 South Sixth street, Philadelphia, Pa.: Renwick detained in Boston; will be at my office for cross-examination on Tuesday, at eleven o'clock. B. F. Lee."

And states that he showed Mr. Hamilton's clerk the press copy of said original telegram in the letter book kept by him, whereupon said clerk took a copy of it, on June 19, 1876; and the hour of 11.50 having arrived without the attendance of either counsel for defendants, letters, of which the following is a copy, were sent to the offices of Judge Shipman and Mr. Hamilton, and were delivered at their respective offices at or before 12 o'clock:

53 NEW YORK, *June 20th*, 1876—11.50 a. m.

U. S. C. C., dist. of Maine.

GOODYEAR D. V. Co. *vs.* STROUT. } and five other cases.

E. LUTHER HAMILTON, Esq.:

DEAR SIR: Mr. Renwick is patiently waiting here in room 51, before the examiner, for cross-examination in these cases. It does seem to be time that we should be relieved from the expense and trouble of securing his further attendance.

No one is present for the defence this morning.

Yours truly,

B. F. LEE.

We shall dismiss Mr. Renwick at 12.30, our case being closed.

B. F. L.

The letter to Judge Shipman being in all respects the same, except that it was addressed to Hon. W. D. Shipman, instead of E. Luther Hamilton, esq.

Thereupon the hour of 12.40 p. m. having arrived, the witness, Henry B. Renwick, is relieved from further attendance, and this examination is closed.

NEW YORK, *August* 8, 1876—11 a. m.

Present, B. F. Lee, esq., of counsel for complainants, and Henry Baldwin, jr., and E. Luther Hamilton, esq., of counsel for defendants.

Cross-examination of Henry B. Renwick by HENRY BALDWIN, Jr.:

Cross-question 6. In how many cases, prior to these, have you testified as an expert respecting this Cummings reissue No. 1904?

Answer. I don't remember exactly; I remember the case against Smith, and the case against Preterre, the former in Massachusetts and the latter in the southern district of New York.

Cross-ques. 7. In both of those cases the said reissue No. 1904 was the same patent of John A. Cummings respecting which you gave your evidence in this case, was it not?

Ans. Yes.

54 Cross-ques. 8. In said Smith case in your direct examination were you not asked to state what you find to be the invention embraced in said reissue; and did you not answer, "A new article of manufacture consisting of a plate of hard rubber or vulcanite, with teeth or teeth and gums secured thereto in the manner described in the patent, the whole making what is sometimes called a case, or in ordinary language a set of artificial teeth?"

Ans. By reference to the record I find that I did.

Cross-ques. 9. In that case were you not asked in the direct examination to state how the complete vulcanite dental plate, described in the Cummings reissued patent No. 1904, differs in its process of manufacture, and the thing itself when made, from dental plates made of gold or other metal with teeth attached thereto; and did you not answer thereto in part as follows?

To save time and trouble counsel for the respective parties hereby consent that a copy of Mr. Renwick's deposition in said Smith case shall be hereto annexed as containing the answer to the last question and to such further questions as counsel for defendants would otherwise deem it necessary to put in that behalf. In consideration of putting in this copy an answer to the question is waived.

And it is further agreed that a copy of Mr. Renwick's deposition in the said Preterre case shall be hereto annexed as containing answers to similar questions touching the substance of his testimony in that case.

Cross-ques. 10. Recurring to your testimony in these cases in which you are now being cross-examined; in the latter part of your answer to the 2d direct question you say "If a plate of vulcanite were formed into proper shape, and the teeth were then riveted to it, as they have been to a metal plate, then the completed article, with the teeth riveted to the vulcanite, would not be the new article of manufacture described in the Cummings Patent"; do you say this, meaning that the plate of vulcanite formed into proper shape as you specify should be in the soft or in the hard condition when the teeth were riveted to it?

Ans. In the hard.

Cross-ques. 11. If the plate were formed into proper shape of the vulcanizable compound, and the teeth then attached to it while the plate was in the soft condition, and the plate then subjected to

55 heat and vulcanized, would the resulting vulcanite case or set of teeth be the new article of manufacture described in the Cummings patent, reissue No. 1904?

Ans. It might be, and might not; if the teeth could be stuck into the formed plate of compound, so that the compound made a tight joint around them and held them in place, and if it then could be success-

fully vulcanized, the plate would be a Cummings plate; if the teeth were soldered to a piece of metal and that riveted to a piece of vulcanizable compound, as teeth are fastened to metal plates, and then the compound could be vulcanized, it would not, in my opinion, be a Cummings plate. I do not know whether either of these ways of making the set of teeth could be carried out practically, but I do know that the thing that I referred to in my direct testimony, namely, as vulcanite plate shaped like a gold plate, could be produced and the teeth rivited to it as to a metal plate after it had been vulcanized.

Cross-ques. 12. Was not your testimony in the Smith case based upon an understanding of the Cummings patent, reissue No. 1904, being only for a case or set of teeth, the base or plate of which was made of a vulcanizable compound, converted by the Goodyear process into vulcanite?

Ans. I cannot say that it was; I noticed the word equivalent in the claims of the patent, but in studying the case before testifying, dismissed the word from consideration as far as the Smith case was concerned, because in that case the thing sued was admitted to be a vulcanite plate; after that time my opinion was requested as to whether a case formed in part of rose pearl or celluloid would be an infringement of the patent; and after considering the thing carefully for some days I came to the conclusion that it was.

Cross-ques. 13. Is not the term "or its equivalent" in the reissue No. 1904 restricted to equivalents of hard rubber or vulcanite, that is, to compounds which are vulcanizable and have been vulcanized?

Ans. No, not as I understand it.

Cross ques. 14. Then what do you understand by the direction in the reissue No. 1904, which I quote: "the soft rubber or gum, so inserted in the mould, is to be compounded with sulphur, rubber, etc., in the manner prescribed in the patent of Nelson Goodyear, dated May 6th, A. D. 1851, for making hard rubber, and is to be subjected to sufficient heat to vulcanize or harden it, substantially as directed in that patent."

56 Ans. I understand that every patentee is obliged to describe clearly one way of carrying out his invention; in this case one way of making the new article of manufacture, which is the subject-matter of the patent; and that the words quoted are a part of the direction how to make a plate which, when complete, shall be composed of vulcanite and mineral teeth.

Cross-ques. 15. Are you familiar with the patent of Nelson Goodyear, dated May 6th, 1851, for making hard rubber?

Ans. I was at one time very familiar with it; I can't say that I am now.

Cross-ques. 16. Do you know that in that patent Mr. Goodyear states that the "indispensable ingredients used in my composition are caoutchouc and sulphur?"

Ans. On referring to a copy of the patent I see that the words are in it as quoted in the question.

Cross-ques. 17. In that patent is it not stated that "in no case will a much less quantity of sulphur than four ounces to every pound of caoutchouc be sufficient?"

Ans. I answer the same as to the last question.

Cross-ques. 18. You have said that you do not understand that celluloid is compounded with sulphur, or has any sulphur in it; do you understand that celluloid is compounded with caoutchouc or gutta-percha or any kind of India rubber or other vulcanizable gum?

Ans. I do not.

Cross-ques. 19. In your answer to question 3 you refer to the attempts to cast whole undersets of pure tin by George E. Hawes and *and* William A. Royce; did you refer to the depositions given by them in the Smith case, as to the publications in the American Journal of Dental Science, volume 1, new series, Oct. 1850, pages 1 to 12, which is one of the exhibits in said case?

Ans. I can't state positively; I had prior to giving that answer read all the depositions in the Smith case, including those of Hawes and Royce, and all the exhibits, and probably had all of them in my mind when making the answer.

Cross-ques. 20. To what "attempts made to use unvulcanized gutta-percha" do you refer in your answer to question No. 3?

Ans. I refer to the attempts described prior to the date of Cummings' invention, in exhibits in the Smith case.

Cross-ques. 21. Can you specify the exhibits in which these attempts are described?

57 Ans. I can't, except one, and that not by name; it was a French publication in which the teeth were described as being attached by "crampons metaliques." On reference to my testimony in the Preterre case I find that this publication was Defendants' Exhibit No. 52; and by reference to the Smith case I find that the name of the party who proposed to make such sets of teeth was Delabarre, jr.

Cross ques. 22. In what does the Delabarre set of unvulcanized gutta-percha differ from a Cummings set of teeth, as an article of manufacture, aside from the fact of its being unvulcanized?

(Objected to as already fully answered by the witness in his cross-examination.)

Ans. The great difference between the two sets is that the Cummings set is exceedingly useful, and that the Delabarre set is good for nothing; which fact I have ascertained by experiment. The crude gutta-percha is not in *an* any sense an equivalent of vulcanite, as it has neither its elasticity, its hardness, or its tenacity; and it is incapable of so holding teeth that they can be used for the ordinary purposes of mastication; it cannot so hold them, even when at the ordinary temperature of a room, and it supports them much more feebly and imperfectly when at the ordinary temperature of the mouth. Teeth stuck in a plate of putty made to fit the shape of the mouth would, in one way of looking at the matter, differ from a Cummings set only in the fact that putty was used instead of vulcanite; but I should say that when the two things were completed they were entirely different. The difference between the sets referred to in the question would arise from the fact that the crude gutta-percha was used in one, and vulcanite in the other.

Cross-ques. 23. If the compound of rubber and sulphur is formed into a plate or set of teeth as described in the Cummings patent and not vulcanized, would that compound have the same elasticity, hardness or tenacity, as Delabarre's unvulcanized gutta-percha plates?

Ans. I have seen some unvulcanized India-rubber compound (rubber and sulphur), which was just about as hard, tenacious and elastic as crude gutta-percha, perhaps a little more tenacious. That which I have seen in its unvulcanized state, sold for the purpose of being made into artificial teeth, is usually softer, less tenacious and less elastic than crude gutta-percha.

Cross-ques. 24. Then the vulcanite set would derive its superiority over the Delabarre set from the process of vulcanization, would it not?

58 Ans. It would derive its superiority because the vulcanite when finished has the qualities before referred to by me; and as contrasted with the vulcanizable compound, those qualities exist in the vulcanite because it has been submitted to the process of vulcanization.

Cross-ques. 25. Is not vulcanite substantially different in its properties of hardness and elasticity from the unvulcanized but vulcanizable compound?

Ans. It is.

Cross-ques. 26. Is vulcanite substantially different in its properties of hardness, tenacity and elasticity from unvulcanized gutta-percha, India rubber and other vulcanizable gums?

Ans. It is.

Cross-ques. 27. In your answer to question 3 you say "a plate constructed on Cummings' system possesses qualities which clearly distinguish it from all the sets of teeth preceding it; in the first place it fits better as the dentist is enabled to form the plate upon the original plaster cast of the mouth, thus dispensing with the difficult and inaccurate process of constructing dies and counter dies, stamping the plate up between them; the result is necessarily an accuracy of fit not to be attained by the old method;" do you understand Cummings' patent, reissue No. 1904, to comprise this system of forming the plate as a part of the invention therein described? I mean without dies or counter dies.

Ans. I do not. I use the word system, perhaps inaccurately, as synonymous with plan, or in other words as if the quotation read Cummings' plate possesses qualities which, etc.; if the shape of the plate could be secured in any other way than that described by Cummings, or by the use of other devices for shaping it, I should still consider it Cummings' plate, when it was done.

Cross ques. 28. Is not the plan of obtaining the form of the mould in which the plate is to be shaped as described in the reissue No. 1904, described in the attempt to cast whole under sets of pure tin by George E. Hawes and William A. Royce which you have referred to?

Ans. It is.

Cross-ques. 29. Is the joint attained in the Cummings plate a tighter joint or a more perfect joint between the teeth and the plate than is found in the continuous gum plates which you have referred to in your 3d answer?

Ans. I have never broken a continuous gum set to pieces to ascertain the tightness of the joint; never have seen but one or two
59 sets at the most; my memory is that after the set was finally completed, the joint where the outside surface of the procelain touches the teeth is as tight as it is in a Cummings case; whether that joint is tight over the whole surface of the teeth or not I don't know, but it probably is so, after the repeated applications of porcelain paste, and repeated bakings, so as to fill the cracks, which is, as I have been informed, the process used in making these continuous gum sets.

Cross-ques. 30. Do you not know it to be a fact that in a vulcanite set, after more or less use, the teeth become loosened in their sockets, so that there are crevices between the teeth and plate into which fluids from the mouth enter and decompose?

Ans. I do not.

Cross-ques. 31. Have you any knowledge of the state of the art of artificial dentures prior to the date of the reissue No. 1904, aside from publications and patents?

Ans. Yes; I have seen sets or partial sets of teeth before that time—

I don't remember any other than metal; and have seen dentists at work on them; I cannot call to mind any positive case where I have seen vulcanite sets before that time, although I may have seen them.

Cross-ques. 32. You have referred to solid collodion as described before the date of the Cummings reissue as a substance which might be used where vulcanite had been used, and that you had seen it yourself (although you could not state that it was before the date of the Cummings patent) used for knife handles and for cheap jewelry, as vulcanite is used; how was this solid collodion manipulated in forming it into the articles you have mentioned?

Ans. I do not know how it was manipulated in order to form the articles I saw.

Cross ques. 33. What were the liquid solvents in those collodions, if any, other than ether?

Ans. I don't remember any other than ether, although the patents or publications may describe some other.

Cross-ques. 34. How far, within your knowledge of vulcanite, is it susceptible of being remoulded after it has been once vulcanized?

Ans. I have seen buttons, with ornaments on them in relief, which I was informed were moulded out of valcanite after it had been vulcanized. I have an indistinct rememberance of having seen other
60 articles moulded from vulcanite but don't feel justified in swearing positively.

Cross-ques. 35. You have spoken of the resemblance between vulcanite dental plates and celluloid dental plates; is not this resemblance due to the fact that both seek to imitate as well as possible the natural color of the parts which they are intended to replace?

Ans. No; the resemblance that I spoke of is owing to the fact that both have about the same elasticity, hardness and tenacity, and both hold the teeth embedded in them with a tight fit around the teeth; this resemblance would be the same if they were both colored black.

Adjourned to August 9, 1876, at 11 a. m.

NEW YORK, *August* 9, 1876—11 a. m.

Present, counsel as before.

Redirect examination of HENRY B. RENWICK by Mr. LEE:

Witness desires to state that question 32 of the cross-examination has brought to his attention his answer to direct question 4, in which he has used the word "reissue" in the second line of page 51 of the testimony as printed, when he intended to have said, "Cummings' original patent," instead of "Cummings' reissue," and desires that the answer to the 4th direct question may be corrected accordingly.

R. D. question. 36. Will you produce the deposition of Henry J. Fisk referred to in your 6th question and answer in the Preterre case which has been referred to in your cross examination in this case?

In order to save unnecesary encumbrance of the record it is agreed that in answer to this question the witness may produce only those parts of the deposition of Fisk which are especially in reference to the dental plates of "celluloid" and "rose pearl," desired by him.

Ans. I produce the parts of the Fisk deposition referred to, which are in the words and figures following, to wit:

The deposition of Henry B. Renwick, in the Smith case above referred to, is annexed and marked Exhibit Renwick, Smith Deposition, J. A. S., Ex'r.

The deposition of Henry B. Renwick, in the Preterre case above re-

ferred to, is also annexed, and marked Exhibit Renwick, Preterre Deposition, J. A. S., Ex'r.

61 The parts of the Fisk deposition referred to are hereunto annexed and form an exhibit marked Exhibit Fisk Deposition, J. A. S., Ex'r, and the text of said exhibit completes the witness' answer to redirect question No. 36.

HENRY B. RENWICK.

Subscribed and sworn to before me, this 9th day of August, 1876.
JOHN A. SHIELDS, *Examiner.*

The defendants may have until August 19, 1876, to put in their evidence in defence, provided that said testimony shall all be taken in the city of New York, and that the first session before the examiner for taking the same shall be on or before Tuesday, August 15, 1876, at 11 a. m.

B. F. LEE,
For Complainants.
C. A. SEWARD,
For Defendants.

Exhibit Renwick, Smith Deposition.—J. A. S., Ex'r.

Deposition of Henry B. Renwick.

DECEMBER 12, 1873.

Direct examination by counsel for complainants:

Int. 1. What is your name, age, residence, and occupation?

Answer. Henry B. Renwick; fifty-six years old; I reside in the city of New York; my principal occupation, at present, is the examination of machinery and processes in the arts, and I am frequently called as expert in the circuit court of the United States in various circuits in suits in which patents are in question.

Int. 2. Have you examined the reissued letters-patent, No. 1904, granted to the Dental Vulcanite Company, assignee of John A. Cummings, dated March 21st, 1863, for improvement in artificial gums and palates, and do you understand the invention therein described?

Ans. I have frequently read copies of the reissue named in the question, among others a certified copy, and believe that I understand the invention therein described.

62 Int. 3. Please state what you find to be the invention embraced therein?

Ans. A new article of manufacture consisting of a plate of hard rubber or vulcanite with teeth, or teeth and gums secured thereto in the manner described in the patent, the whole making what is sometimes called a case, or, in ordinary language, a set of artificial teeth.

Int. 4. Have you examined the letters-patent of the United States, granted to Nelson Goodyear, dated May 6, 1851, No. 8075, for improvement in manufacture of India rubber, and do you understand what is therein described?

Ans. I have examined the patent referred to in the question some years ago, and lately a copy thereof in the printed record in this case, and I understand what is therein described.

Int. 5. Please compare what is described in said Goodyear patent No. 8075, with what is described in said Cummings reissue No. 1904, and state whether you find described or suggested in said Goodyear patent the invention embraced in said Cummings reissue?

Ans. The Goodyear patent of 1851 describes the compound now known as vulcanite and the method of making it. It does not suggest or hint at the combination of that material with teeth in the manner described in the Cummings reissue, and does not, therefore, describe the invention embraced in that reissue.

Int. 6. Have you examined the English letters-patent granted to Alfred Vincent Newton, No. 13542, enrolled the fourth day of September, 1851, and dated March 11th, 1851, and do you understand what is therein described? And if yea, please compare what is described in said Newton patent with what is described in said Cummings reissue, and state whether you find described and suggested in said Newton patent the invention embraced in said Cummings reissue?

Ans. I have examined a copy of the Newton patent in the printed record in this case. It contains a description substantially identical with that in the Goodyear patent before referred to; also a description of how articles of vulcanite that have been formed in moulds may be vulcanized out of the moulds by pressing them in pulverized soapstone, sand, etc.; also a description of how iron may be covered with vulcanite by wrapping the iron with a sheet of vulcanizable compound, and then binding it fast to the iron with strips or ribbons of cloth, and finally vulcanizing the compound while it is surrounded by the strips
63 or ribbons. I do not find any suggestion in this patent of the article described in the Cummings reissue; in fact, the description, if read, would rather deter an inventor from experimenting to produce such an article, as it would be impossible to vulcanize teeth imbedded with rubber so as to form a dental plate, if the teeth and vulcanizable compound were secured together by strips or ribbons of cloth during the process of vulcanization.

Int. 7. Have you examined the letters patent of the United States granted to John Allen, dated December 23, 1851, No. 8721, for improvement in setting mineral teeth, and do you understand what is herein described? And, if yea, compare the same with what is described in said Cummings reissue, and state whether you find described or suggested in said Allen patent the invention embraced in said Cummings reissue.

Ans. I have examined a copy of the Allen patent printed in the record in this case. It describes a method of making a set of artificial teeth by using an ordinary metal plate and securing the teeth to the plate by means of a cement, which is a sort of porcelain paste, which is applied to the teeth and the metal plate and afterwards baked into porcelain, the gums being formed of the same porcelain paste, which is converted into porcelain at the same baking. In this way the inventor states that the usual method of attaching teeth to a metal plate is dispensed with; but that they may be attached in the usual way by means of a back-plate. I have never seen a set of teeth made in this way, without the metallic back-plate. When made with the back-plate, the article described is the ordinary continuous gum set of teeth. I find in this patent no suggestion or description of either vulcanite itself or of the article of manufacture described in the Cummings reissue.

Int. 8. Have you examined the English letters patent granted to Edwin Thomas Truman, dated August 15th, 1848, No. 12241, for improvement in constructing and fixing artificial teeth and gums, etc., and do you understand what is therein described? And, if yea, compare the same with what is described in said Cummings reissue, and state whether you find suggested or described in said Truman patent the invention embraced in said Cummings reissue.

Ans. I have frequently and carefully examined a copy of the Truman patent referred to in the question, which forms a part of the printed record in this case. It is a patent for making a case or set of teeth. In order to make such a set, a skeleton plate is first prepared, fur-
64 nished with proper pins upon which the teeth are to be cemented. This skeleton plate or metal frame, the patent states, may be made of wire or otherwise, and its purpose is to support the pin upon which the artificial teeth are cemented. After this plate has been made it is to be enveloped in pure gutta-percha or wax, the wax or gutta-percha surrounding the upper part of the teeth, which are in place upon their pins but not cemented thereto, and the gutta percha or wax serving, as it were, as a cushion, making the fit between the skeleton plate and the alveolar ridge and roof of the mouth, if it be an upper set, and also furnishing the artificial gums which appear outside and at the top of artificial teeth. After the gutta percha or wax has been moulded around the metal frame or plate the teeth are pulled out, their pins attached to the frame are covered with wax, and the wax or gutta percha is gilded. The wax is then removed from the pins and the teeth are shoved into their sockets and cemented on the pins in the same manner as when using gold plates. The patentee states that the gilding may be dispensed with; but he no where states that the cementing of the teeth fast to the metal frames or skeleton plate can be dispensed with, and I know from experiments with gutta percha and wax that the teeth could not be held for the purpose of mastication unless they were so cemented to the frame. The great object of the patentee seems to have been to obtain a set of teeth which would perfectly fit the surface of the mouth and gums; and this fit is obtained by surrounding a metal frame with wax or gutta percha. I do not find in this patent any description of vulcanite, any description of teeth attached to vulcanite in any way, not even a suggestion of the article of manufacture which is described in the Cummings reissue.

Int. 9. Please look upon defendant's Exhibit No. 49 in this cause, being article No. 720, from a work entitled Great Exhibition of the Works of all Nations, etc. (defendant's record, page 397), and state whether you have examined and understand the same, and compare what is described therein with what is described in said Cummings reissue, and state whether you find suggested or described in said article the invention embraced in said Cummings reissue?

Ans. The exhibit referred to in the question is a publication of a few lines. I cannot discover precisely what it refers to. All that I can gather from it is that four things were exhibited, viz: 1st, a set of teeth with "gutta percha gums;" 2d, a set of teeth mounted in gutta percha; 3d, a small set of teeth; and 4th, specimens of pure gutta percha.
65 The exhibit does not describe or suggest the new article of manufacture which is the subject of the Cummings reissue.

Int. 10. Have you examined defendant's Exhibit No. 50 in this cause, being an extract from the Reports of the Juries, Exhibition of 1851, page 598 (defendants' record, page 397), and state whether you understand the same, and compare what is described therein with what is described in said Cummings reissue, and state whether you find suggested or described in said article the invention embraced in said Cummings reissue?

Ans. The exhibit is a statement that Mr. Truman has discovered that a lump of gutta percha, moulded into the form of a jawbone, was capable of holding artificial teeth, and thus superseding those settings in gold which were so costly. I do not find in this exhibit any sugges-

tion or description of the article of manufacture described in the Cummings reissue.

Int. 11. Examine defendant's Exhibit No. 51 in this cause, being an article from the American Journal of Dental Science, for January, 1852, pages 332 and 333 (printed on pages 397 and 398, defendant's record), and state whether you understand the same, and compare what is described therein with what is described in said Cummings reissue, and state whether you find suggested or described in said article the invention embraced in said Cummings reissue?

Ans. The first paragraph in the exhibit is a statement that Mr. Parsons had in his possession a set of teeth, the entire base of which is composed of a preparation of gutta percha, and that he does not regard the material suitable for the purpose. There is no statement of what the composition of the preparation is, or how it is combined with the teeth. The second paragraph is a statement that a preparation of gutta-percha has been used as a base for artificial teeth; that teeth made on such a base had realized his most sanguine expectations, and that if they proved really valuable, after a sufficient test, he would make the discovery known. There is no description as to the way in which this gutta-percha is prepared, or how it is combined with other material (which is the sense conveyed to me by the word preparation), and no description of the manner of attaching the teeth to it. This exhibit does not suggest or describe the invention which is specified in the Cummings reissue.

Int. 12. Examine defendant's Exhibit No. 52 in this cause, being an article extracted from Comptes-Rendus Hebdomaderies des Seiances
66 des l'Academie des Sciences, etc., Tome treute-troisieme, Juillet Decembre, 1851 (printed on pages 398, 399, 400 of defendants' record), and state whether you understand the same, and compare what is described therein with what is described in said Cummings reissue, and state whether you find suggested or described in said article the invention embraced in said Cummings reissue, and state whether a practically useful dental plate can be made from the description contained in said articles.

Ans. I have examined the French description, as printed in the record, and also the translation thereof. There are several errors in the translation, three of which it may be proper to refer to. The word "bain marie" is translated "wet bath." The French word really means a double vessel, with water or some other liquid contained between the two vessels, so that whatever is contained in the inner vessel cannot be heated to a greater degree than the boiling-point of the liquid. A common glue-pot is a good illustration of what is meant by a bain marie. The word "moulage" is translated by the word "casting." This word in English applies both to the act of casting and to the thing procured by casting. The sense of the French, as I understand it, is, that the matrice is produced by a double moulding in plaster, viz, first, a moulding from the alveolar arch and roof of the mouth, so as to get a counterpart of them, and then a moulding from this plaster mould, so as to obtain a reproduction in plaster of the contour of the alveolar ridge, etc. The word "crampons," in French, is translated "staples," and the word "metalliques," immediately following it, is untranslated. The words "crampons metalliques" really mean metallic cramps; i. e., pieces of wire bent into the shape of a ship-carpenter's "dog," as the cramps with which pieces of stone are fastened together. A crampon is a metal rod, with the two ends bent at right angles to the rest of the rod.

This exhibit describes a set of teeth made by inserting teeth into a plate and gums of gutta-percha, the teeth being fastened by means of cramps. There is no statement whether one end of these cramps is to be secured into the teeth or is to hook around the teeth. As teeth for dental purposes, whether artificial or natural, generally have wires fastened into them, I understand the description to direct that one end of the crampons is to be fastened into the teeth. Sets of teeth hanging from one another in detail might be made, all complying with the very general statements of this description. In order to make a set of
67 teeth according to this description I should first take a cast of the alveolar arch and root of the mouth. From this cast I should take a second one, which would be a reproduction of the parts of the mouth. This latter cast is, as I understand it, the matrice of the description contained in the exhibit. I should procure some gutta-percha and place it in an ordinary glue-pot, filling the space between the inner and outer part with water. I should then place the gutta-percha in the inner part, put the glue-pot on the fire, bring the water up to the boiling-point (which is one hundred Centigrade), and keep it boiling. When the gutta percha was as hot as the pot, I should strive in some way or other to color it. The exhibit does not describe what material is to be used for coloring the gutta-percha or how it is to be applied so as to color it.

The next step would be to take a lump of the soft gutta-percha and press it into the matrice until it made a tight fit, then by means of knives, spatula, etc., to form the gums and give shape to that part of the plate which is visible when it is in use. I should then take the teeth, with the crampons attached to them, heat them, and insert them in place, shoving the bent end of the crampons into the gutta percha. The exhibit does not state whether the crampons are to be wholly imbedded in the gutta-percha, or whether parts of them are to appear on the surface. After the teeth were stuck in and fastened by the crampons, I should trim off and re-shape the outside of the gutta-percha plate, which would be much distorted by the insertion of the teeth. There is no statement in the exhibit that this operation is to be performed; but the plate could not be put in the mouth and worn unless it was so trimmed. The description, as a whole, is vague and general. I could make a set of teeth, and have had two sets made, which would conform to the terms of this general description, but whether they were or were not made in the precise manner that Mr. Delabarre intends to have them made I cannot say. This exhibit does not describe or refer to vulcanite. It does not describe an article of manufacture in which a vulcanizable compound is vulcanized in contact with teeth, and does not suggest or embrace the invention described in the Cummings reissue. After reading this description and considering it carefully, I procured a piece of sheet gutta-percha about the thickness of Exhibit Gutta-Percha, and put it in my mouth and let it remain there a few minutes until it acquired the temperature of my mouth. I then found that I could, by biting upon it, bite half through it or more, and from this drew the conclusion that, if I made artificial teeth set in gutta-percha and bit
68 upon them, then the teeth would sink into the gutta percha and carry the gutta-percha down with them, so as to injure my gums; the gutta percha, at the temperature of the mouth, not being rigid enough to cause a pressure upon one or two teeth to be transferred over the whole surface of the gutta-percha resting upon the alveolar arch. These experiments also prove that the gutta-percha would not retain its

shape under the pressure of the jaws, but would take a different shape, and not return to its original one. I chewed some pieces of gutta-percha for a few minutes, and, under the pressure, it thinned down to one sixty-fourth of an inch or less in thickness, and did not resume its original shape. I also softened gutta-percha and inserted hot teeth into it with bent pins about one eighth of an inch long, then let the gutta-percha harden, then heated it in water to ninety-two degrees, and found that a slight force would throw these teeth out when they were inserted deeper than teeth usually are in vulcanite. I threw this tooth out by holding the gutta-percha with my fingers against the palm of my hand, throwing the teeth out with the thumb of the same hand. I could not measure the force, but I know it was much less than that occasioned by my jaws in masticating food.

After these trials I had a copy of the translation of the exhibit made, and wrote at the botton of it the definition of bain-marie and crampons, as defined by me in this answer. I took this to Dr. Rushmore, who has been examined in this case, caused him to read it, and asked him if he understood it. He said that he did. I then told him to make the best set of teeth that he could, according to that description. Some days after (Saturday evening last) I went to Dr. Rushmore's, and he produced a set of teeth which looked much like Exhibit Rushmore, No. 2. I examined the case or set of teeth, and asked him to go to his laboratory and bring up some teeth with the same kind of wires in them as those in the case which he had made. While he was gone, I held the set of teeth in my right hand, and with the thumb of the same hand threw one or two of the front teeth out. When he came up I threw others of the teeth out in the same way. I showed him this, and told him that I did not think he had given the description in the exhibit a fair enough chance and that he must go to work and make another set with crampons half an inch long, or nearly so. I did not see the other set, which is Exhibit Rushmore No. 2, until after it had been put in its present condition. From these experiments, I am of the

69 opinion that a set of teeth made in accordance with the general description found in the exhibit would be useless for the purpose of mastication, but that a set would serve a temporary purpose while a permanent set was being made, the gutta-percha set being useful only to preserve the looks of the person wearing them, and as an aid to articulation. I say temporary, but do not know how long they would last, even if not used to chew on, as I do not know of my own knowledge what effect would be produced on gutta-percha by the gases and fluids of the mouth.

Int. 13. Have you examined Defendant's Exhibit No. 41, being an article from the Lancet, vol. 2, September 13th, 1845, pages 284 to 287, and vol. 2, September 20th, 1845, pages 210 to 212 (defendant's record, from pages 327 to 331 inclusive), and do you understand the same? And compare what is described in said article with what is described in said Cummings reissue, No. 1904, and state whether you find described or suggested in said article the invention embraced in said reissue?

Ans. I have examined the article referred to in the question. It describes experiments in making artificial palates or parts of palates, of India rubber, or soft, vulcanized India rubber, such as shoes are made of. The palate referred to in this description, is, as I understand it, the organ which hangs in front of the throat, and is not what dentists sometimes call the palate, namely, the roof the mouth, although I may be be mistaken on this point. This exhibit does not even name vulcanite,

or sets of teeth mounted on vulcanite, and does not suggest or embrace the invention described in the Cummings reissue.

Adjourned.

SATURDAY, *Dec.* 13, 1873.

Int 14. Will you produce, to be marked as an exhibit in this cause, a specimen of vulcanized, soft rubber, such as is referred to in your last answer; and will you also produce as an exhibit, a specimen of the gutta-percha referred to in your answer to the 12th question, which you yourself experimented with; and also state what was the temperature of the set of teeth mounted on gutta-percha when you threw the teeth out at Dr. Rushmore's, as stated in your answer to the said 12th question.

70 Ans. I produce a specimen of soft, vulcanized rubber; also a specimen of gutta-percha. I did not look at the thermometer in Dr. Rushmore's room, but I should judge that its temperature was from 60 to 65 F., and the set of teeth were at the temperature of the room when I shoved the teeth out of it.

(Complainants' counsel offers the piece of soft, vulcanized rubber in evidence, and the same is marked Exhibit Soft Rubber, J. A. S., Examiner; also, the piece of gutta-percha referred to by witness in last answer, and the same is marked Exhibit Gutta-Percha, No. 2, J. A. S., Examiner.)

Int. 15. Examine Defendant's Exhibit No. 57, being an article from the New York Dental Recorder, volume 3d, No. 4, January, 1849, page 80 (printed on pages 400 to 402, defendant's record), and state whether you understand the same, and compare what is described therein with what is described in said Cummings reissue, and state whether you find described or suggested in said article the invention embraced in said reissue.

Ans. I understand the exhibit. It is a statement that artificial palates may be made of gutta-percha or gutta-percha with a piece of soft, prepared rubber attached to it. The article contains a statement that the writer is ignorant of the length of time during which gutta-percha will resist the action of the fluids of the mouth, and hopes that his plan will be fully tested. Teeth mounted upon anything are not referred to in the exhibit; neither is vulcanite or hard rubber. The exhibit does not describe or suggest the invention embraced in the reissue of Cummings.

Int. 16. Examine Defendant's Exhibit No. 62, being an article from the New York Dental Recorder, for October, 1851, being an article signed "A. Hill," dated October 22, 1861, printed on pages 122 and 123 of defendant's record, and compare what is described therein with what is described in said Cummings reissue, and state whether you find described or suggested in said article the invention embraced in the said reissue of Cummings.

Ans. I do not understand the exhibit referred to in the question. It speaks of an artificial compound in which teeth may be set without the necessity of backing or soldering in the ordinary way. The article does not state what the compound is, and I therefore cannot compare the exhibit with what is described in Cummings reissue.

Int. 17. Examine the following defendant's exhibits:

71 No. 38. Being an article from the American Journal of Dental Science, vol. 1, October, 1850, printed on pages 332 to 337 of defendant's record.

No. 39. Being an article in said journal for October, 1850, and printed on pages 337 to 340 of defendant's record.

No. 40. Being an article from the Dental News Letter. January, 1851, rinted on pages 332 to 337 of defendant's record.

No. 55. Being an article from the New York Dental Recorder, 1850, and printed on pages 402 to 404 of defendant's record.

No. 56. Being an article from the Dental Register of the West, 1850, and printed on pages 402 to 404 of defendant's record.

And state whether you understand the same, and compare what is described in each of said exhibits with what is described in said Cummings reissue, No. 1904, and state whether you find described or suggested in said articles, or any of them, the invention embraced in said Cummings reissue.

Ans. Exhibits 38 and 40 are the same. They describe two ways of making sets of atificial teeth. The first plan is to prepare a gold plate in the usual way; then by means of wax, etc., to fit the teeth in place; the next process is to put a thin gold back upon the teeth in the usual way, and the backing is then soldered to the plate by tin, and tin is also soldered on in front of the teeth, so as to imitate that portion of the alveolar ridge which has been absorbed. There is a statement, also, that the piece is to be burnished up before finishing.

A set of teeth thus made would be the same as what is known as a continuous gum set, except that tin, or, as is stated in the latter part of the exhibit, common soft solder is used instead of the porcelain paste, which is baked on to the gold plate and teeth in continuous gum sets. In the second method of making sets of teeth described in this exhibit, plaster moulds and a wax plate and gum are used, as described in the Cummings reissue, up to that stage of the process where the result is two plaster moulds, enclosing between them a space which has the same boundaries as the desired plate, and one of which plaister moulds has the teeth sticking in it, and arranged in the relative position which they are to occupy in the mouth. After this result has been obtained, the two plaster moulds are to be secured together, heated up to the temperature of melted tin, and melted pure tin poured into the cavity. This tin will surround, or partially surround, the teeth
72 and the pins attached thereto, which latter, having been previously covered with flux, will be soldered into the tin plate. After the tin has cooled the plaister is removed, and the plate is then to be finished with the same care as a gold plate. The next statement is, that the plate should be worn for a few days, altered, if necessary, and finally gilded and burnished.

Exhibit 39 describes various experiments; the sets of teeth resulting from such experiments being substantially the same as those described in Exhibits 38 and 40.

Exhibits 55 and 56 describe sets of teeth in which the plates are made wholly of tin, or of tin loaded upon a gold plate, to which the teeth have been soldered by means of the usual backing. These sets, when finished, are substantially the same as those described in Exhibits 38 and 40.

I understand what is described in each of these exhibits; they do not describe vulcanite or hard rubber, and do not describe or suggest the invention embraced in the Cummings reissue.

Int. 18. State how the complete vulcanite dental plate, described in the Cummings reissue patent, No. 1904, differs in its process of manufacture, and the thing itself, when made, from dental plates made of gold, or other metals, with teeth attached thereto.

Ans. I have never worn artficial teeth of any kind, and can therefore answer the question only from my knowledge of vulcanite and its

properties; also, of metals and their properties, and from examinations of sets of teeth made in various ways.

Some twelve or thirteen years ago I made for the India Rubber Comb Co. a long series of experiments upon vulcanite, and became tolerably familiar with the properties of that substance, and also of its behaviour during the vulcanizing and first processes of manufacture. The essentials of the process for manufacturing the article of manufacture described in the Cummings patent are, first, that the teeth shall be partially embedded in the vulcanizable compound in its plaster or putty-like state, with a tight fit between the compound and the teeth, the teeth being properly arranged, and the compound being shaped into the form of the desired plate; second, that the compound with the teeth in it should be vulcanized while the teeth are held in proper position in the compound. The reissued patent describes vulcanization as being effected in plaster moulds which hold the teeth in position in the compound. I know of no process for forming sets of artifi-
73 cial teeth in which the essentials of the process described in the reissue are employed, nor is it suggested in any of the exhibits. It is true that those exhibits which relate to sets of teeth mounted upon a tin base do describe a method of forming plaster moulds with teeth stuck fast in one-half of the mould, which is identical with the preparatory part of the process described in the reissue, namely, that which describes the preparation of a mould of plaster with teeth stuck in it, the cavity of the mould being the counterpart of the desired plate. But this is the precise point at which the essentials of the process described in the patent commence.

I know, from prior experience, that vulcanite compound does not shrink in the process of vulcanizing. I therefore had reason to believe that, if properly packed around the teeth, it would form a perfectly tight joint around the teeth after vulcanization. I knew that it was a very tough and strong material, and therefore believed that it would preserve this tight joint unimpaired when the teeth were in use. In order to test these conclusions, I broke up a lower set of teeth made in accordance with the Cummings patent, which I now produce. I first tried to get some of the teeth out with an iron claw, and broke the teeth before I could loosen them. I then tried to break the set in two with my fingers, but could not; then put it on a block of wood and struck it with a hammer until I broke it in the middle, and finally broke it again before I could get some of the teeth out. I noticed that the vulcanite had been in close contact with the teeth, because I found the surface of the vulcanite, where the teeth had been in contact with it, an exact counterpart of the *of the* enamel surface of the teeth, and in those places where the enamel had been ground off I found that the vulcanite actually adhered to the surface of the teeth. As far as I can judge, this set of teeth was not made in the best way or of first-rate vulcanite, but it still exhibited the qualities of strength and tightness of fit in a remarkable degree. I know of no set of teeth formed of any other substance in which the teeth make a tight fit with the base upon which they are set after they have been a short time in use. This tightness of fit is of the utmost importance, as the fluids and gases of the mouth will enter crevices which are only visible by the aid of a magnifier, and when they do enter they soon become very offensive to the sense of smell, and I know of no way of cleaning out such crevices when they once become foul. The qualities of strength and elasticity possessed by vulcanite make it peculiarly applicable for sets of teeth.

74 Sets of teeth made in any way known to me, prior to the date

of the Cummings application, except sets carved out of some kind of ivory, which have gone out of use, will usually bend or break if let fall upon the floor, and the slightest bend in fact destroys the set, because it destroys the fit of the set to the mouth, and when that fit is destroyed the set cannot be repaired. Sets of vulcanite teeth are not hurt by being thrown upon the floor, nor are they hurt even if sufficient force is applied to bend them, the elasticity of the vulcanite causing the set of teeth to return to precisely their original contour. I have seen an upper set of vulcanite teeth placed with the teeth downward upon the floor, and then seen a man, weighing, I should judge, about one hundred and twenty, stand upon them with one foot, then lift upon the other foot and hop up and down upon the teeth. After he had hopped upon them several times with his whole weight, the set was examined and found uninjured. This quality of elasticity of a set of vulcanite teeth is useful in another way when partial sets of teeth are employed, the sets in such cases being made a little too large, and the spring of the plate itself serving to maintain it against the remaining natural teeth. This quality of elasticity residing in the Cummings article of manufacture does not exist in sets of teeth having basis of porcelain, gutta-percha, tin, silver, gold, or platina, or combinations of these materials. It is true that gutta-percha has a sort of leathery or imperfect elasticity, but if bent in any considerable degree it will not resume its original contour.

In making sets of teeth which are composed in whole or in part of metal plate the plate is fitted upon a copy of the mouth, and is swedged on to it; it is impossible, in this way, to obtain an exact fit, although a pretty near approach to a fit is made. In making sets of teeth with tin bases, the tin is cast upon a counterpart of the mouth, but the tin shrinks in cooling, and in consequence cannot make a perfect fit. I have no experience with such a set, but I should think it would be necessary to improve the fit of a tin plate after it was cast by means of proper tools. In a set of teeth mounted on gutta-percha the fit could be made perfect, but, as I before stated, such a set would be useless for the purpose of mastication.

The vulcanizable compound of rubber and sulphur will, as I know, conform itself to the minutest depressions or elevations of a mould, and the vulcanite will preserve all the features which are impressed upon the vulcanizable compound, and, as I have before stated, will not shrink in the process of vulcanizing. I have, when vulcanite compound was to be cured, or vulcanized in moulds of sheet-tin (thick tin-foil), written my name with the end of a watch key (thus slightly indenting the foil) upon the foil after it was impressed upon the vulcanizable compound, and have always found the name impressed upon the compound after it was cured or vulcanized.

I have also vulcanized at the same time sheets of compound enveloped in sheet-tin, and other sheets enveloped in tin-plate, which is tinned sheet-iron; and have been able, after vulcanization, without difficulty, to distinguish one sheet of vulcanite from another after the enveloping plates had been stripped off, being able thus to distinguish them, owing to the fact that the surface of the vulcanite was a perfect counterpart of the surface of the metallic enveloping plate. Owing to these properties of vulcanite, sets of teeth can be made of it which originally and after use make a closer and better fit to the mouth and to the teeth than can be produced by the use of any other material. It is true, when teeth are mounted upon tin bases cast around them, that the tin shrinks away from the teeth in the act of cooling, thus leaving fissures,

and that these fissures can be superficially stopped by burnishing; but as the teeth are then held rigidly only by the pins and slight edge of film produced by the burnishing operation, it seems to me that the teeth would soon flatten or reduce the edge made by the burnishing, thus leaving the joint between the teeth and the tin open. I think that the teeth would thus act upon the tin owing to the great pressure exercised by the jaw, combined with the grinding or sidewise action of the jaw in the mastication of food.

I know that vulcanite is not attacked by the fluids and gases of the mouth; know it from examination of sets of teeth that have been worn; but this same quality is inherent in gold and platina, and in silver, although the latter metal does not possess it in so great a degree.

(Counsel for complainants offers in evidence the fragments of the plate broken up by Mr. Renwick, and referred to by him in last answer, and the same are marked Exhibit Broken Vulcanite Set, J. A. S., Ex'r.

Int. 19. Examine Defendant's Exhibit No. 53, being the article from Revue Odontotechnique, 1860, printed on pages 404 to 407 of defendant's record, and state whether you understand the same, and state whether the same is correctly and accurately translated.

76 Ans. I understand the exhibit; there are several inaccuracies in the translation; none of importance, except one; the French part of the exhibit contains the words "les petits crochets." These words are translated on page 407 by the words "the little metal ties." There is no authority in the French for this word "metal," and the proper translation would be "little hooks or clasps." The true sense of the French is, that when vulcanite is used for a set of teeth, then the hooks or clasps may be made of the vulcanite itself, thus dispensing with the metal.

Adjourned.

DECEMBER 15, 1873.

Cross-examination by HENRY BALDWIN, Jr., Esq., of counsel for defendant:

Cross-int. 20. What do you mean by the words "in the manner described," as used by you in your answer to question No. 3?

Ans. I mean that the teeth are to be partially surrounded by the vulcanite in such manner that a tight joint is made between the vulcanite and the teeth, and that the teeth are secured by pins, which are imbedded in the vulcanite.

Cross-int. 21. Is that all that is comprised in the words "in the manner described," as used by you in your answer to question No. 3?

Ans. Yes; but it may be proper to state that I know of no way in which the teeth can be secured in the manner described except by placing them in the vulcanizable compound, or placing the vulcanizable compound around the teeth and pins, while the compound is in a putty-like state, and before it is cured or vulcanized.

Cross-int. 22. Then you find the invention embraced in the Cummings reissue No. 1904 to be a new article of manufacture, consisting of a plate of hard rubber or vulcanite with teeth, or teeth and gums secured thereto, the teeth being partially surrounded by the vulcanite in such a manner that a tight joint is made between the vulcanite and the teeth, and that the teeth are secured by pins which are imbedded in the vulcanite, the whole making a case or set of artificial teeth; is not that your definition?

Ans. Yes.

Cross-int. 23. Then if this defendant has not made his rubber or vul-

canite plates and secured the teeth or teeth and gums thereto in the manner described in said patent, as you have just defined such
77 manner, have the plates made by him contained the invention which you find embraced in the Cummings reissue No. 1904?

Ans. I do not understand that the manner in which the defendant made the plates affects the question. The question with me would be, what the plate was after it was made; if the plate, after it is made, is not substantially like that described in the Cummings reissue, it does not contain the invention specified therein; I have never seen one of the defendant's plates.

Cross-int. 24. If it be a fact that in the vulcanite plates made by the defendant, the teeth, though partially surrounded by the vulcanite, are not so surrounded that a tight joint is made between the vulcanite and the teeth, do such plates contain the invention embraced in the Cummings reissue No. 1904?

Ans. It is impossible to answer such a question truly without seeing one of the plates.

Cross-int. 25. If it be a fact that in many vulcanite dental plates in use the secretions and gases of the mouth can and do enter between the teeth and the walls of the socket in which they are contained, would such plates be substantially different on that account from the vulcanite dental plate described in the Cummings reissue No. 1904?

Ans. I could not tell without seeing them; the plate, as a whole, might be made exactly like Cummings', except that it was badly made; I should then say that it contained the Cummings invention; or it might have some teeth without a tight fit, loosened by use on account of imperfections in the manufacture; I should then say that it contained the Cummings invention; so it might have teeth mounted on a metallic backing, and riveted on a plate which had previously been vulcanized; in the last case it would not contain the invention.

Cross-int. 26. Please take the plate now shown you, heat the plate, or some of the teeth, and remove the teeth, and state whether you find between the teeth and the plate deposits from the secretions of the mouth.

Ans. I could not answer the question even after performing the operation.

(Defendant's counsel requests the examiner to note that the two extreme molar teeth on the left-hand side have been removed from the plate just shown the witness before the plate was shown him.)

78 WITNESS continues: I have taken out the two blocks on the right-hand side of the plate; I cannot tell what the gray looking efflorescence is; but it does exist there; the discoloration of the rubber is owing to the partial charring to which it was subjected in order to remove the teeth; the heat which effected this charring was derived chiefly from the teeth, which are also discolored by the heat; the teeth were heated in the flame of a gas-burner.

Cross-int 27. Does that plate contain the invention embraced in the Cummings reissue No. 1904?

Ans. As far as I can ascertain by inspection, it does.

(Plate referred to is put in evidence by defendant's counsel, and marked Defendant's Exhibit Vulcanite Plate, Dec. 15, 1873, J. A. S., examiner.)

Cross-int. 28. Is the question whether or not, in a vulcanite dental plate, the teeth are partially surrounded by the vulcanite in such manner that a tight joint is made, one which determines whether or not the set contains the invention embraced in the Cummings reissue?

Ans. I have, already, in substance, answered that question, viz, that

it does not necessarily determine the question, because the plate might be substantially like Cummings', and made in the same manner as Cummings', and yet, through accident or design, have one or more of the joints imperfect.

Cross-int. 29. If the rubber or other material is first moulded to fit the shape of the mouth and the gums formed, and while soft and pliable, the teeth are imbedded in the gums, and as an additional security fastened to the same by small pins, and the teeth, gums, and plate thus connected, then baked until the elastic material becomes sufficiently vulcanized, does such plate, so made, contain the invention which you find embraced in the Cummings reissue, No. 1904?

Ans. As I understand the question, it does not define the material of which the completed plate is made as vulcanite; the question speaks of an elastic material before it is vulcanized; the compound of rubber and sulphur, before vulcanization, is not elastic; it is like putty; in order to get a Cummings set of teeth, you must first have a vulcanizable compound of gum and sulphur, and, finally, vulcanite. I cannot answer the question as propounded; it is too indefinite.

Cross-int. 30. Can you not understand from the last question that the material is vulcanized?

79 Ans. I cannot; because the first part of the question speaks of other material, and the last part of it talks of vulcanizing an elastic material.

Cross-int. 31. Can you not understand from cross-interrogatory No. 29 that the material used is vulcanizable?

Ans. No, I cannot; because I know of no vulcanizable material but India rubber and allied gums, and I know of no vulcanite which is procured by baking an elastic material.

Cross int. 32. Assume the material used to be a vulcanizable compound of rubber and sulphur, and answer cross-interrogatory No. 29 upon that assumption.

Ans. If the material is a vulcanizable compound of rubber and sulphur, and in proper proportions to make vulcanite, and it is formed while soft into the shape of a plate, and the teeth are then embedded in it with pins as an additional security, and the teeth and plate are then subjected to heat, so as to vulcanize the compound, then the article produced would be the article described in the Cummings reissue, the assumption, of course, being that the article, when produced, has the teeth in the proper place.

Cross-int. 33. If the rubber or other material used is first formed into a plate properly fitting the mouth, and then vulcanized, the teeth being secured to it after vulcanization in any suitable manner, would the case or set of teeth thus produced contain the invention embraced in the Cummings reissue?

Ans. I should say no.

Cross-int. 34. If a gold plate is struck up between the dies, and then connected with the teeth by means of rubber compound, which is afterwards vulcanized, would the case or set of teeth thus produced contain the invention embraced in the Cummings reissue, No. 1904?

Ans. The question is so indefinite that it is impossible to answer it accurately. I can see no way of making such a plate except by making the Indian rubber strong enough to sustain the teeth, and by vulcanizing the gold plate into the India rubber so that the vulcanite partially or wholly surrounds the gold plate. In such an article the gold plate would be a surplussage and nothing else; and the article, if in other respects like Cummings', would be his article of manufacture.

Cross-int. 35. If a case or set of teeth is made by securing the
80 teeth to a wire frame, bent into a shape approximating that of the mouth, and then covering this frame with the rubber compound, so as to form the plate and gums, and then vulcanizing them, does such a case so made contain the invention embraced in the Cummings reissue, No. 1904?

Ans. If I understand you rightly, the plastic compound is to partially surround the teeth so that they will be embedded in it, and also to partially or wholly surround the wires attached to the teeth, and that the compound is then to be vulcanized in contact with the teeth and wires. A set so made would, so far as I can judge, be the Cummings article of manufacture. It would differ in degree and form from Cummings' in having long, and uselessly long, wires or pins.

Cross int. 36. As you understand it, does any change take place in the nature of the teeth themselves from the process of vulcanizing the plate with which they are connected?

Ans. No.

Cross-int. 37. In your opinion, would gutta-percha compounded with sulphur, or with sulphur and other ingredients, in the manner described in the patent of Nelson Goodyear, No. 8075, dated May 6, 1851, for making hard rubber, and subjected to sufficient heat to vulcanize it, be the equivalent of the vulcanite described in the Cummings reissue, No. 1904.

Ans. I do not find gutta-percha mentioned in the Goodyear patent, referred to in the question. Gutta-percha mixed with sulphur in proper proportions and then vulcanized would be the equivalent of the vulcanite described in the Cummings reissue. It would be, as far as my experience leads me to judge, an inferior equivalent.

Cross-int. 38. Do you consider the vulcanization of the plate in the mould in which it is formed an essential part of the process of making vulcanite plate described in the Cummings reissue, No. 1904?

Ans. I do not.

Cross-int. 39. Then, if the plate of rubber compound, after being moulded upon the teeth as described in the Cummings reissue, No. 1904, should, with the teeth in it, be removed from the mould, and should be completely surrounded by soapstone powder which is placed in a box, so that the plate is completely surrounded and covered by the pulverized soapstone, and embedded in the same, and if then the soap-
81 stone powder should be subjected to pressure, and then by means of a cover the compressed soapstone powder should be retained in close contact with the plate and teeth, and if the said plate in this condition should be heated to the required degree and for the required time to vulcanize the plate, would or would not the vulcanite plate thereby produced be substantially the same vulcanite plate as is described in the Cummings reissue, No. 1904?

Ans. It would be substantially the same.

Cross-int. 40. Have you observed the action in the mouth of sets of artificial teeth; and, if yea, to what extent?

Ans. I have not, as I never wore them.

Cross int. 41. Have you ever made a cast-tin dental plate?

Ans. I never have.

Cross-int. 42. Have you seen a cast-tin dental plate removed from the mould immediately after it was cast and cooled?

Ans. No.

Cross-int. 43. Except in the case of Dr. Rushmore's experiments men-

tioned in your answer to question No. 18, have you ever seen a set of teeth jumped on or stood on?

Ans. I have not.

Redirect by Mr. DICKERSON:

Int. 44. Did you undertake to make a set of teeth upon a base of tin in the manner described by Dr. Hawes?

Ans. I had directions given to a dentist to get the moulds made with the teeth inserted in them, and all other things in readiness to make several sets of tin teeth, and caused tin to be purchased for the purpose of casting it around the teeth in the moulds. I was notified when all was ready, and on what days the experiment could be made, but on those days was confined to my bed. As soon as I got well, I was obliged to go to Boston to be examined in a patent suit, and when I came back was shown the exhibits in this case, which are cases made by casting tin around teeth. After seeing those exhibits, I deemed experiment on my part unnecessary.

Int. 45. What fact appeared on those exhibits which led to the conclusion you have last stated?

Ans. I observed that defendant's exhibits E. W., under sets Nos. 11 and 15, and George E. Hawes, No. 3, had been burnished with a
82 burnishing-tool, very forcibly applied at the points where the tin came in contact with the teeth, at the point where such contact was visible. This burnishing was necessary for one purpose only, viz, to try and fill up the crevice between the teeth and the tin. I noticed that, in spite of the power applied, this burnishing had not been successful, and that there were still, in several places, open crevices between the teeth and the tin. After making these observations, I concluded that it was unnecessary to try any experiment with a view of proving whether the tin did or did not shrink away from teeth around which it had been cast. The exhibits satisfied me that it would shrink away from the teeth.

Int. 46. Have you a piece of sheet-tin which you procured of about the thickness of gold plate used for dental plates? If so, produce one.

Ans. I have, and produce it. I ordered pure tin to be bought.

(Sheet of tin referred to by witness offered in evidence by complainants' counsel, and marked Complainants' Exhibit Sheet-Tin, Dec. 15, 1873, J. A. S, Ex'r.)

HENRY B. RENWICK.

Attest:

JOHN A. SHIELDS, *Examiner.*

83 United States circuit court, southern district of New York. In equity.

THE GOODYEAR DENTAL VULCANITE COMPANY and JOSEPH BACON
against
ADOLPH P. PRETERRE.

Testimony taken on behalf of complainants for a final hearing under and in pursuance of the 67th rule of the Supreme Court, in equity, as amended, before John A. Shields, esq., examiner.

Exhibit Renwick, Preterre deposition.—J. A. S., Ex'r.

NEW YORK, *September* 18, 1875.

Deposition of Henry B. Renwick.

Present, B. F. Lee, esq., of counsel for complainants, and George R. Schieffelin, esq., for defendant.

HENRY B. RENWICK, a witness called on behalf of complainants, being duly sworn, testifies as follows:

Question 1. What is your name, age, residence, and occupation?

Answer. Henry B. Renwick; fifty years old. I reside in the city of New York. My principal occupation at present is the examination of machinery and processes in the arts, and I am frequently called as expert in the circuit court of the United States, in various circuits, in suits in which patents are in question.

Ques. 2. Have you examined the reissued letters patent No. 1904, granted to the Dental Vulcanite Company, assignee of John A. Cummings, dated March 21st, 1865, for improvement in artificial gums and palates, and do you understand the invention therein described; and, if yea, please state what you find to be the invention embraced therein?

Ans. I have frequently read and examined the reissued letters patent No. 1904, granted to the Dental Vulcanite Company as
84 assignee of John A. Cummings, dated March 21st, 1865, and I thoroughly understand the same, and the invention described therein; the invention as claimed may be described as a new article of manufacture, consisting of a plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth, with teeth or teeth and gums secured thereto in the manner described in the patent, the whole making what is sometimes called a case, or, in ordinary language, a set of artificial teeth. The manner described in the patent of securing the teeth to the plate, is by imbedding the teeth and pins in the plate while the substance of which it is composed is in a soft or plastic condition, so that when the material composing the plate becomes hard the teeth are firmly secured by being imbedded with their pins in the substance composing the plate so that there is a tight joint between the plate and the teeth, the whole forming substantially one piece. The material composing the plate, must, when hardened, be an elastic material, possessing and retaining in use sufficient strength and rigidity for the purpose of mastication, and at the same time being elastic enough to yield a little to the motion of the mouth. It may be said here, as further illustrating my idea of what the invention is, that it does not consist in the mere application of vulcanite, or a substance possessing the same characteristics for the required purpose in place of metal; for instance, if a plate of vulcanite were formed into proper shape and the teeth were then riveted to it as they have been to a metal plate, then the completed article with the teeth riveted to the vulcanite would not be the new article of manufacture described in the Cummings patent.

Ques. 3. Have you examined the following defendant's exhibits, and do you understand what is described in each of the same? And, if yea, compare what is described in each of said defendant's exhibits with the invention described and claimed in said Cummings' reissue No. 1904, and state whether if in any of them you find described or suggested the invention embraced in said Cummings reissue.

Defendant's Exhibit No. 1, being the Goodyear patent, No. 8075, of 1851 (defendant's Smith record, pages 223 to 226).

Defendant's Exhibit No. 61, being the English patent to A. V. Newton, No. 13542, of 1851 (defendant's Smith record, pages 190 to 196).

Defendant's Exhibit No. 63, being the U. S. patent to John Allen, No. 8621, of 1851 (defendant's Smith record, pages 197 to 199).

85 Defendant's Exhibit No. 12, being the English patent to E. T. Truman, No. 12-41, of 1848 (defendant's Smith record, pages 267 to 270).

Defendant's Exhibit No. 49, being an article from a work entitled Great Exhibition of the Works of all Nations, etc. (defendant's Smith record, page 397), 1851.

Defendant's Exhibit No. 50 (defendant's Smith record, page 397), 1852.

Defendant's Exhibit No. 51 (pages 397 and 398, defendant's Smith record, January, 1852).

Defendant's Exhibit No. 52 (pages 398, 399, and 400, of defendant's Smith record, 1861).

Defendant's Exhibit No. 41 (pages 327 to 331, inclusive, of defendant's Smith record, 1845).

Defendant's Exhibit No. 57 (pages 400 to 402, defendant's Smith record, 1849).

Defendant's Exhibit No. 62 (pages 122 and 123 of defendant's Smith record, October, 1851).

Defendant's Exhibt No. 33 (pages 332 to 337 of defendant's Smith record, October, 1850).

Defendant's Exhibit No. 39 (pages 337 to 340 of defendant's Smith record, October, 1850.)

Defendant's Exhibit No. 40 (pages 332 to 337 of defendant's Smith record, January, 1851).

Defendant's Exhibit No. 55 (pages 402 to 404 of defendant's Smith record, 1850).

Defendant's Exhibit No. 56 (pages 402 to 404 of defendant's Smith record, 1850).

Ans. I have examined all the exhibits named in the question. Believe that I understand what is described in each of them, and proceed to compare the articles described in each of them with the article described and claimed in said Cummings reissue. The Goodyear patent of 1851 describes the compound now known as vulcanite and the method of making it. It does not suggest or hint at the combination of that material with teeth in the manner described in the Cummings reissue, and does not therefore describe the invention embraced in that reissue.

Defendant's Exhibit No. 61, being the English patent to Newton, 13,-542, contains a description substantially identical with that in the Goodyear patent before referred to. Also a description of how articles

86 of vulcanite that have been formed in moulds may be vulcanized out of the mould by pressing them in pulverized soapstone, sand, &c. Also a description of how iron may be covered with vulcanite by wrapping the iron with a sheet of the vulcanizable compound, and then binding it fast to the iron with strips or ribbons of cloth, and finally vulcanizing the compound while it is surrounded by the strips or ribbons. I do not find any suggestion in this patent of the article described in the Cummings reissue. In fact, the description, if read, would rather deter an inventor from experimenting to produce such an article, as it would be impossible to vulcanize teeth imbedded with rubber so as to form a dental plate, if the teeth and vulcanizable compound were secured together by strips or ribbons of cloth during the process of vulcanization.

Defendant's Exhibit No. 63, which is the United States patent granted to John Allen, No. 8621, describes a method of making a set of artificial teeth by using an ordinary metal plate, and securing the teeth to the plate by means of a cement, which is a sort of porcelain paste, which is applied to the teeth and the metal plate, and afterwards baked into porcelain, the gums being formed of the same porcelain paste, which is converted into porcelain at the same baking. In this way the inventor states that the usual method of attaching teeth to a metal plate is dispensed with, but that they may be attached in the usual way by means of a back plate. I have never seen a set of teeth made in this way without the metallic back plate. When made with the back plate the article described is the ordinary continuous gum set of teeth. I find in this patent no suggestion or description of either vulcanite itself or any similar material, or of the article of manufacture described in the Cummings reissue. The defendant's Exhibit No. 12, No. 12241, English patent to Truman, is a patent for making a case or set of teeth. In order to make such a set a skeleton plate is first prepared furnished with proper pins upon which the teeth are to be cemented. This skeleton plate or metal frame, the patent states, may be made of wire or otherwise, and its purpose is to support the pins upon which the artificial teeth are cemented. After this plate has been made it is to be enveloped in pure gutta-percha or wax, the wax or gutta-percha surrounding the upper part of the teeth which are in place upon their pins, but not cemented thereto, and the gutta-percha or wax serving, as it were, as a cushion, making the fit between the skeleton plate and the alveolar ridge and roof of the mouth, if it be an upper set, and also furnishing the artificial gums
87 which appear outside and at the top of artificial teeth. After the gutta-percha or wax has been moulded around the metal frame or plate the teeth are pulled out, their pins attached to the frame are covered with wax and the wax or gutta-percha is gilded; the wax is then removed from the pins and the teeth are shoved in their sockets and cemented on to the pins in the same manner as when using gold plates.

The patentee states that the gilding may be dispensed with; but he nowhere states that the cementing of the teeth fast to the metal frames or skeleton plate can be dispensed with, and I know, from experiments with gutta-percha and wax, that the teeth could not be held for the purpose of mastication unless they were so cemented to the frame. The great object of the patentee seems to have been to obtain a set of teeth which would perfectly fit the surface of the mouth and gums, and this fit is obtained by surrounding a metal frame with wax or gutta-percha. I do not find in this patent any description of vulcanite, any description of teeth attached to vulcanite or a substance having the physical properties thereof, in any way, not even a suggestion of the article of manufacture which is described in the Cummings reissue.

Defendant's Exhibit No. 49, being article No. 720, from a work entitled Great Exhibition of the Works of All Nations, etc., is a publication of a few lines in length. I cannot discover precisely what it refers to. All that I can gather from it is that four things were exhibited, viz: 1st, a set of teeth with "gutta-percha gums"; 2d, a set of teeth mounted in gutta-percha; 3d, a small set of teeth; and 4th, specimens of pure gutta-percha. The exhibit does not describe or suggest the new article of manufacture which is the subject of the Cummings reissue.

Defendant's Exhibit No. 50, being an extract from the reports of the jury, exhibition of 1851, is a statement that Mr. Truman has discovered that a lump of gutta percha, moulded into the form of a jaw bone, was capable of holding artificial teeth, and thus superseding those settings

in gold which were so costly. I do not find in this exhibit any suggestion or description of the article of manufacture described in the Cummings reissue.

Defendant's Exhibit No. 51 is an article from the American Journal of Dental Science for January, 1852. This paragraph in the exhibit is a statement that Mr. Parsons had in his possession a set of teeth, the entire base of which is composed of a preparation of gutta-percha, and that he does not regard the material suitable for the purpose. There is no statement of what the composition of the preparation is or how it is combined with the teeth. The second paragraph is a statement

88 that a preparation of gutta-percha has been used as a base for artificial teeth; that teeth made on such a base had realized his most sanguine expectations, and that if they proved really valuable, after a sufficient test, he would make the discovery known. There is no description as to the way in which this gutta-percha is prepared or how it is combined with other material (which is the sense conveyed to me by the word preparation), and no description of the manner of attaching the teeth to it. This exhibit does not suggest or describe the invention which is specified in the Cummings reissue.

Defendant's Exhibit No. 52 is an article from Comptes Rendus Hebdomadaires des Seiances de l'Academie des Sciences, etc., Tome trente troisieme, Juillet, Decembre, 1851, and contains a suggestion for making dental plates of gutta-percha, in which either natural or porcelain teeth are fixed by means of "crampons metalliques," which are pieces of wire bent into the shape of a ship-carpenter's dog.

Exhibit Roby, Gutta-Percha, J. G., Jr., is a piece of gutta-percha such as is referred to in the description. It is not an elastic substance, such as vulcanite is, although it has a sort of pliability at ordinary temperatures. At the ordinary temperature of the human mouth, it becomes so soft that it is incapable of holding artificial teeth during mastication, and even at the ordinary temperature of a room it will not hold teeth when a force much less than that of ordinary mastication is employed to remove them. I have ascertained these facts by experiment, not only with teeth stuck into gutta percha, but also by trials of sets of teeth composed of mineral teeth, inserted in gutta-percha, and held there by crampons. It is obvious that this exhibit does not describe an article of manufacture substantially identical with that described in the Cummings reissue, nor even similar to it; and judging from my experiments, I believe that a dental plate constructed in accordance with the exhibit would be practically useless for the purposes of mastication. I may say, in reference to the French article and its translation, that the sense of the French, as I understand it, is, that the matrix is produced by a double moulding in plaster, namely, first, a moulding from the alveolar arch and roof of the mouth, the latter being a counterpart of the former; and then a second moulding from this plaster mould, so as to obtain a reproduction in plaster of the alveolar ridge, etc. The word "moulage" in the French is translated by the word "casting" in the translation, and such translation may give a false impression of the real meaning of the French phrase.

89 Defendant's Exhibit No. 41 describes experiments in making artificial palates or parts of palates of India rubber or soft vulcanized India rubber, such as shoes are made of. The palate referred to in this description is, as I understand it, the organ which hangs in front of the throat, and is not what dentists sometimes call the palate, namely, the roof of the mouth, although I may be mistaken on this point. This exhibit does not even name vulcanite or any substance having the physi-

cal characteristics of vulcanite, or sets of teeth mounted on vulcanite, and does not suggest or embrace the invention described in the Cummings reissue.

Exhibit Roby vulcanized soft rubber, J. G., Jr., is a specimen of soft vulcanized rubber, such as is referred to in Exhibit No. 41.

Defendant's Exhibit No. 57 is a statement that artificial palates may be made of gutta-percha or gutta-percha with a piece of soft, prepared rubber attached to it; the article contains a statement that the writer is ignorant of the length of time during which gutta-percha will resist the action of the fluids of the mouth, and hopes that his plan will be fully tested; teeth mounted upon anything are not referred to in the exhibit, neither is vulcanite or hard rubber, or any substance having its properties; the exhibit does not describe or suggest the invention embraced in the reissue of Cummings.

Defendant's Exhibit No. 62 is an article from the New York Dental Recorder. I do not understand it. It speaks of an artificial compound in which teeth may be set without the necessity of backing or soldering in the ordinary way. The article does not state what the compound is, and I therefore cannot compare the exhibit with what is described in Cummings' reissue.

Defendant's Exhibits Nos. 38 and 40 are the same. They describe two ways of making sets of artificial teeth. The first plan is to prepare a gold plate in the usual way, then by means of wax, etc., to fit the teeth in place; the next process is to put a thin gold back upon the teeth in the usual way, and the backing is then soldered to the plate by tin, and tin is also soldered on in front of the teeth, so as to imitate that portion of the alveolar ridge which has been absorbed. There is a statement also that the piece is to be burnished up before finishing. A set of teeth thus made would be the same as what is known as a continuous gum set, except that tin, or as is stated in the latter part of the exhibit, common soft solder is used instead of the porcelain paste, which is baked on to the gold plate and teeth in continuous gum sets. In the second method of making sets of teeth described in this exhibit, plaster moulds
90 and a wax plate and gum are used as described in the Cummings reissue, up to that stage of the process where the result is two plaster moulds, enclosing between them a space which has the same boundaries as the desired plate, and one of which plaster moulds has the teeth sticking in it, and arranged in the relative position which they are to occupy in the mouth; after this result has been obtained, the two plaster moulds are to be secured together, heated up to the temperature of melted tin, and melted pure tin poured into the cavity; this tin will surround or partially surround the teeth and the pins attached thereto, which latter, having been previously covered with flux, will be soldered into the tin plate; after the tin has cooled the plaster is removed and the plate is then to be finished with the same care as a gold plate; the next statement is that the plate should be worn for a few days, altered if necessary, and finally gilded and burnished. I have seen tin plates thus made with the tin cast around the teeth; they were introduced as exhibits by the defendants in the suit brought by the complainants in this suit against Daniel H. Smith in the district of Massachusetts; these plates were not elastic; did not have a tight joint between the teeth and the tin owing to the shrinkage of the tin in cooling; for this same reason it was impossible to make them accurately fit the mouth, and further, in them the teeth were necessarily injured during the process of casting. These plates or sets were for lower jaws only; if they had been made for upper jaws, with sufficient thickness of tin to support

the teeth firmly, they would have been impracticable on account of their weight.

Exhibit Roby, pure tin, J. G., Jr., is a piece of tin of about the thickness of an ordinary silver or gold plate, and a handling of the exhibit proves that a dental plate made of that thickness of tin would be useless. Exhibit 39 describes various experiments; the sets of teeth resulting from such experiments being substantially the same as those described in Exhibits 38 and 40. Exhibits 55 and 56 describe sets of teeth in which the plates are made wholly of tin, or of tin loaded upon a gold plate, to which teeth have been soldered by means of the usual backing; these sets, when finished, are substantially the same as those which are described in Exhibits 38 and 40. I say, in reference to Exhibits 38, 39, 40, 55 and 56, that none of them describe any elastic material as a base for teeth; neither do they refer to vulcanite or hard rubber, or any substance having the properties and characteristics thereof; and none of them suggest or describe an article of manufacture similar to that that is described and claimed in the Cummings reissue.

91 Ques. 4. Examine defendant's Exhibit No. 53, printed on pages 404 to 407 defendant's Smith record, and state whether you understand the same, and whether the same is correctly and accurately translated?

Ans. I understand the exhibit; there are several inaccuracies in the translation—none of importance except one; the French part of the exhibit contains the words "les petits crochets;" these words are translated on page 406 by the words "the little metal ties;" there is no authority in the French for this word "metal," and the proper translation would be "the little hooks or clasps;" the true sense of the French is, that when vulcanite is used for a set of teeth, then the hooks or clasps may be made of the vulcanite itself, thus dispensing with the metal.

Ques. 5. State how the sets of teeth described in the Cummings patent reissue 1904 differ from dental plates made of gold, silver, or platinum, including what are known as platinum continuous gum sets?

Ans. Laying out of view the attempts to cast whole undersets of pure tin by George E. Hawes and William A. Royce, and the attempts made to use unvulcanized gutta-percha, which, as I understand, were unsuccessful and impracticable, the only sets of teeth in practically successful use were made by striking up thin sheets of gold, silver or platinum between a die and counter-die, and then soldering the teeth to the plate by means of small platinum pins attached to the teeth; the die and counter die were formed by taking a wax or plaster impression of the part of the mouth proposed to be fitted by the finished plate; from that impression a plaster cast was taken, which was an exact model of the mouth; from this model a mould in sand was made, into which was cast a hard metal—zinc being generally used for the purpose; this formed the die, which was thus a reproduction of the plaster model; a counter-die of lead was then cast, fitting the face of the zinc die; the sheet of metal was then stamped into shape between the die and counter-die; the high temperature which platinum will bear without melting enabled the dentist to apply to sets of teeth, when mounted on a platinum base, a sort of porcelain paste, which was applied to the teeth and metal plate, and afterwards baked into porcelain, the gums being formed of this paste, which was converted into porcelain by the baking; these were known as continuous gum sets of teeth; as I understand, however, owing to the great expense of such sets of teeth and their

92 great weight, but few of them were used; a plate constructed on

Cummings' system possesses qualities which clearly distinguish it from all the sets of teeth preceding it; in the first place it fits better, as the dentist is enabled to form the plate upon the original plaster model of the mouth, thus dispensing with the difficult and inaccurate process of constructing dies and counter dies, and stamping the plate up between them; the result is necessarily an accuracy of fit not to be obtained by the old method; in the second place there is a much tighter joint (I may say a perfect joint) between the teeth and the plate than is found in the old plates, where the porcelain teeth are riveted and soldered to a metal plate; and thus cleanliness and purity are attained by the use of the Cummings plate, owing to the absence of crevices between the teeth and plate, into which, when they exist, fluids from the mouth are apt to enter and decompose; in the third place, the teeth, when imbedded in an elastic material, possessing and retaining in use sufficient rigidity and strength for the purpose of mastication, and at the same time elastic enough to yield a little to the motion of the mouth, are capable of yielding when subjected to the pressure of the opposing jaw about as much as the natural teeth yield in their sockets, thus avoiding the shock that would result from the teeth being rigidly held by a hard, non elastic material.

Ques. 6. Have you read and do you understand the deposition of Henry J. Fisk, taken in this cause, especially in reference to the manufacture of dental plates of celluloid and rose pearl, described by him, and have you read and do you understand the letters-patent of the United States granted to Isaiah Smith Hyatt and others, assignors, to "Albany Dental Plate Company," dated March 28, 1871, and numbered 113055, for "improvement in dental plates from pyroxyline;" and compare such celluloid and rose-pearl plates, and also the manufacture described in said letters-patent No. 113055, with what is described and claimed in Cummings' reissue 1904, and state whether such plates for artificial teeth upon bases of rose pearl or celluloid, or the sets of teeth described in said patent No. 113055, or either of them, resemble or differ from the sets of teeth described and claimed in said reissue 1904?

Ans. I have read the deposition of Henry J. Fisk, and the letters patent No. 113055, referred to in the question, and understand them; I do not consider that Cummings' invention is dependant upon the chemical composition of the plate, any more than it depends upon
93 the chemical composition of the artificial teeth; it is only necessary, in order to apply his invention, that teeth should be used possessing substantially the physical characteristics of artificial teeth, and that they should be imbedded in a plate possessing substantially the characteristics of a vulcanite plate for the purpose for which it is to be used; the physical characteristics of the substance which forms the plate, in order to fit it for holding artificial teeth, in substantially the manner described in Cummings' patent, are, first, capability of being formed or moulded around the roots of the teeth and pins while in a soft or plastic condition; and second, strength and elasticity when hardened such as is possessed by whalebone, ivory, vulcanite and solid collodion, so that it shall be sufficiently strong and rigid for the purpose of mastication and at the same time elastic enough to yield slightly to the pressure of the jaw.

The process described by Fisk and in patent No. 113055 must necessarily result in an article of manufacture containing all the features that constitute, as before stated, the distinguishing characteristics of the vulcanite dental plate. I have examined many vulcanite dental plates, and a considerable number of said solid collodion or "celluloid" or

"rose-pearl" dental plates, and after looking at and handling them was unable to decide which were vulcanite and which celluloid; in fact, I picked out in several instances celluloid as vulcanite, and vulcanite as celluloid. I then compared those composed of the one material with those com' of the other, and could distinguish no difference in their physical characteristics, except in their odor, and in the slight translucency possessed by solid collodion not deeply colored; either the celluloid or rose-pearl dental plate, made as referred to in the question, is in my opinion substantially the article of manufacture described and claimed in the Cummings reissue. The celluloid, the rose-pearl and the vulcanite plates all have the teeth supported by imbedding; all have a close joint between the teeth and the substance which supports them; all have sufficient strength, rigidity, and elasticity; all of them, as I am informed and believe, are unaffected by the fluids of the mouth, and usual foods and condiments; and all of them, by reason of being manufactured by moulding and pressure, without use of metal dies, and therefore without danger of alteration of such dies during stamping, are almost if not quite exact fits to the mouth and alveolar ridge. I am also informed that users cannot distinguish, when in use, sets of teeth made of vulcanite from those made of celluloid or rose-pearl; I am of the opinion
94 previously expressed as to the substantial identity of the three articles, although I know that celluloid and rose-pearl are different chemical compounds from vulcanite, because I believe that the substantial resemblance must be sought in those points or characteristics which are brought into play in actual use, and not in characteristics which are unimportant in such use.

(Counsel for defendant seasonably objected to each and every interrogatory and to each and every answer thereto, in the examination of the witness Henry B. Renwick, for the reason that it is an examination as to the construction of the Cummings patent; and the testimony of an expert is not competent evidence as to the construction of a patent.)

NEW YORK, *October* 11, 1875—11 a. m.

Present, B. F. Lee, esq., of counsel for complainant, and Henry Baldwin, jr., esq., of counsel for defendant.

Examination of Henry B. Renwick continued:

Ques. 7. Will you produce a set of teeth on the celluloid base, and also a set of teeth on the vulcanite base, such as you referred to in your examination, and have them marked as exhibits in this case?

Ans. I produce the two. The plate with the vulcanite base is marked Complainants' Exhibit Vulcanite Set, J. A. S., Ex'r; the plate with the celluloid base is marked Complainants' Exhibit Celluloid Set, J. A. S., Ex'r. I determined certainly which was which by setting fire to the two plates.

Cross-examined by Mr. BALDWIN, de bene esse:

Cross-ques. 8. Were you not examined as an expert in a suit of these complainants against Daniel H. Smith, hereinbefore referred to?

Ans. I was.

Cross-ques. 9. Did you not say in that case, page 173, that "in order to get a Cummings set of teeth, you must first have a vulcanizable compound of gum and sulphur, and finally vulcanite"?

Ans. I did, in answer to cross-interrogatory 29 in that case, which is as follows: "If the rubber or other material is first moulded to fit the shape of the mouth and the gums formed, and while soft and pliable the

teeth are imbedded in the gums, and, as an additional security, fastened to the same by small pins, and the teeth, gums and plate thus
95 connected then baked until the elastic material becomes sufficiently vulcanized, does such plate so made contain the invention which you find embraced in the Cummings reissue No. 1904?" Answer as follows: "As I understand the question, it does not define the material of which the completed plate is made as vulcanite. The question speaks of an elastic material before it is vulcanized. The compound of rubber and sulphur before vulcanization is not elastic; it is like putty. In order to get a Cummings set of teeth, you must first have a vulcanizable compound of gum and sulphur, and finally vulcanite. I cannot answer the question as propounded; it is to' indefinite."

Cross-ques. 10. In answer to cross-question 31 in that deposition, you said: "I know of no vulcanizable material but India rubber and allied gums, and I know of no vulcanite that is made by baking an elastic material." Is that still the case?

Ans. Yes.

Cross-ques. 11. Cross-interrogatory 32 in that deposition was: "Assume the material used to be a vulcanizable compound of rubber and sulphur, and answer cross-interrogatory 29 (which you have cited above) upon that assumption." And your answer was, "If the material is a vulcanizable compound of rubber and sulphur, and in proper proportions to make vulcanite, and it is formed while soft into the shape of a plate, and the teeth are then embedded in it with pins as an additional security, and the teeth and plate are then subjected to heat, so as to vulcanize the compound, then the article produced would be the article described in the Cummings re-issue, the assumption, of course, being that the article when produced has the teeth in proper place." Is that still your answer to the question, assuming it to be repeated?

Ans. It is.

Cross-ques. 12. On your direct examination in that case, interrogatory 3, you were asked, "Please state what you find to be the invention embraced therein" (that is in the Cummings re-issue 1904); and your answer was, "A new article of manufacture consisting of a plate of hard rubber or vulcanite, with teeth or teeth and gums secured thereto in the manner described in the patent, the whole making what is sometimes called a case, or, in ordinary language, a set of artificial teeth." Is that still your understanding of this re-issue?

Ans. It is.

Cross-ques. 13. You say in your direct examination in this pres-
96 ent case, that you have read the Goodyear patent of 1851, No. 8075, and also this Cummings re-issue, No. 1904. Don't you understand that said patent No. 8075 is "the patent of Nelson Goodyear, dated May 6, 1851," referred to in the specification of the Cummings re-issue, No. 1904?

Ans. I do.

Cross-ques. 14. Do you understand that celluloid is compounded with sulphur, rubber, &c., in the manner prescribed in the said Goodyear patent, or is subjected to sufficient heat to harden it, substantially as directed in that patent?

Ans. I do not understand that celluloid is compounded with sulpher, or has any sulphur in it; I understand that it is subjected to heat while in molds to soften it and make it fit the teeth perfectly by pressure, as vulcanite is, and that the celluloid becomes hard when cold, probably hardening while cooling. I also state that the vulcanizable compound becomes of a tarry consistency while subjected to heat in the mold, and

becomes hard when cold, and that I do not know when it commences to harden, whether during the cooling or while at the highest heat.

Cross ques. 15. Do you understand celluloid to be vulcanizable, or the celluloid dental plate to be vulcanized?

Ans. The word vulcanize, as I understand it, has a very limited signification, and is applied only to the treatment by heat of a mixture of India rubber or allied gums with sulphur. As celluloid is not composed of a mixture of rubber with sulphur, I do not understand that a celluloid plate is vulcanized.

Cross ques. 16. Do you understand the re-issue No. 1904 to include any material for constituting the plate which is not vulcanizable, or any plate which is not vulcanized?

Ans. I do; I have already stated in substance, in answer to direct question 6, that I believed a plate of celluloid containing teeth, such as is made by defendant, is included in the re-issue, or, in other words, contains the invention which is patented by the re-issue.

Cross-ques. 17. Let me improve this opportunity of learning what you mean by a new article of manufacture, in your answer to direct question 2 in this case?

Ans. As in answer to question 2 I stated what I consider to be the new article of manufacture referred to in the Cummings patent, I suppose that your question calls for a general definition of a new article of manufacture; I think a new article of manufacture is any article
97 not existing, but found by some human agency, and one that can be transported or carried about; for instance, a new kind of pail, or spoon, or pan, would be a new article of manufacture; of course there are limits to the question, and I should not consider a new steam-engine as a new article of manufacture; while I am unable at the present time to draw any distinct line between portable articles which would or would not come within the definition.

Cross-ques. 18. If a tin pail or a tin spoon was old, would a pail or a spoon made of a new material, say vulcanite, for example, be a new article of manufacture, in your understanding and use of the term?

Ans. It might or might not be, depending upon the state of the art and other circumstances.

Cross-ques. 19. Please give briefly an instance of each case.

Ans. It is hardly possible to give general answers to general questions in such matters, especially in the brief space of an answer; for instance, if a vulcanite ladle had been made before a vulcanite spoon had been made, then ordinarily I should say that a vulcanite spoon would not be a new article of manufacture, in view of the ladle; but if in the use of the vulcanite spoon, some properties of vulcanite came into play as existing in vulcanite, or if the maker of the vulcanite spoon were the first one to discover that an article like a spoon could be made of vulcanite, or if the spoon when made was different in construction from spoons made of metal—for instance, if it were made of two pieces instead of one, as spoons ordinarily are—then I think it would be patentable as a new article of manufacture.

Cross-ques. 20. Do you know how celluloid is shaped before it is put in the molds to make a dental plate?

Ans. I understand it to be in the form of Defendant's Fisk Celluloid Exhibit.

Cross-ques. 21. Did you so understand it when examined in chief in this case?

Ans. I did.

Re-direct by Mr. LEE:

Re-D. ques. 22. In the case vs. Daniel H. Smith, to which you have been referred, what was the material used by the defendant in making his Cummings dental plates?

Ans. Mineral teeth, and hard rubber or vulcanite, being the compound described in the Goodyear patent.

98 Re-cross-examination:

Re-cross-ques. 23. In that case do you know whether the defendant used gum teeth or single teeth?

Ans. If I remember right that fact did not appear in the testimony.

HENRY B. RENWICK.

Subscribed and sworn to before me this 11th day of October, 1875.

JOHN A. SHIELDS,
Examiner, &c.

Circuit court of the United States for the district of New York. In equity.

THE GOODYEAR DENTAL VULCANITE COMPANY and Josiah Bacon
vs.
ADOLPH P. PRETERRE.

Proofs for final hearing, taken on the part of the defendant, before Joseph Gutman, jr., examiner, under and pursuant to the 67th rule in equity.

Exhibit Fisk Deposition.

N. Y., *May* 18*th*, 1875—10 a. m.

Present, Mr. Schieffelin, counsel for defendant, and Mr. Lee, counsel for complainants.

HENRY J. FISK, a witness of lawful age produced on the part of the defendant, having been by me first duly cautioned and sworn to testify the truth, the whole truth, and nothing but the truth, in the matter of controversy herein, and being examined by Mr. Schieffelin, counsel for defendant, deposes and says as follows:

Ques. 1. What is your name, age, residence, and occupation?

99 Ans. My name is Henry J. Fisk. I am 26 years old. I reside at 259 Division avenue, Brooklyn, E. D. I am a dentist.

Ques. 2. Are you working for yourself, or for some one else; and if so, for whom?

Ans. I work for Dr. A. P. Preterre, 159 Bowery.

Ques. 10. What is your position with regard to seeing what is going on in his office?

Ans. I see all the mechanical work and most of the operating; in fact, I have charge of the mechanical department.

Ques. 38. Are there other materials that resemble vulcanite?

Ans. Yes, sir; there are.

Ques. 39. What are their names?

Ans. Celluloid and rose pearl.

Ques. 40. How closely do they resemble vulcanite?

Ans. So closely that patients never notice the difference.

And being cross-examined by Mr. LEE, he says:

Cross ques. 43. You have said that rose pearl and celluloid resemble vulcanite; do they not differ from vulcanite in color?

Ans. Very little; they are both nearly the color of pink vulcanite.

Cross ques. 44. Rose pearl is a compound of solid collodion or pyroxyline with gum copal, is it not?

Ans. That is what it is understood to be. I never analyzed it. I couldn't swear to it.

Cross ques. 45. Celluloid is a compound of solid collodion or pyroxyline with gum camphor, is it not?

Ans. That is what it is understood to be. I couldn't swear to it. I never analyzed it myself.

Cross-ques. 46. When you say that rose pearl and celluloid resemble vulcanite, do you mean to be understood that they are substantially like it in all their physical characteristics, such as elasticity, strength, capacity to hold the teeth, by embedding the same in the material, and all those other qualities which distinguish the vulcanite plate?

(Objected to, for indefiniteness.)

Ans. It is more agreeable and pleasing to the eye, and not so brittle as rubber

Cross-ques. 47. In all other respects except those named in your last answer they are substantially the same?

Ans. Yes, sir.

100 Cross ques. 48. Do you mean by your answer to cross-question 46 that it has a different color from pink rubber?

Ans. I mean that it has a clearer color, although you can change the colors, just as you can the color of pink rubber.

Cross-ques. 50. You are familiar with vulcanite plates, and the process of their manufacture, are you not?

Ans. Yes, sir; somewhat.

Cross-ques. 51. Since you have been at Dr. Preterre's, has he been in the habit of making plates for holding artificial teeth out of celluloid and rose pearl, either himself or by his employees?

Ans. Yes, sir.

Cross-ques. 52. Can you produce as exhibits small sheets or strips of rose pearl and of celluloid, and of vulcanite, in order that the court may see how closely they resemble each other?

Ans. No; I haven't them here with me; but I could furnish them.

Cross ques. 53. Will you so furnish them at the next meeting?

Ans. Yes, sir.

Cross-ques. 54. Then you think one might easily mistake a rose pearl or celluloid dental plate for a vulcanite dental plate, and you know that the patients seldom know the difference?

Ans. They seldom notice the difference. I think any one might mistake them, but a dentist could distinguish the difference upon examination.

Cross-ques. 55. Are the means employed for fastening the teeth to the plate the same in the case of all these three materials?

Ans. Celluloid is just the same, only it is not vulcanized; it is put into a cast iron steam receptacle or regular boiler; this contains a press, with water at the bottom of the boiler; it is heated up to about 240°, and then the moulds are closed together; it lies until it gets cold; this completes the plate.

Cross-ques. 56. The object of the press is to squeeze the material while in a plastic condition, so as to pack it into the mould, and around the base of the teeth and pins, is it not?

Ans. Yes, sir.

Cross-ques. 57. Then do you mean to be understood that, when the celluloid plate is completed, that its structure is precisely the same as that of a vulcanite dental plate, except that the base of one is made of celluloid and the other of vulcanite?

Ans. Yes; I don't see but what it is just the same.

101 Cross ques. 58. Will you please describe minutely the whole process of making a celluloid dental plate, omitting, of course, the packing of the mould with the material in the steam heater as you have first described?

Ans. First, we take a plaster impression of the mouth; then we run plaster into this impression, and get a mould from that, which is an exact counterpart of the mouth itself; and then we take this cast and cover it with a thin sheet of wax, which we form into the exact shape of the intended plate; then we take the teeth, which are made of porcelain, and we set them on this wax in the position which we wish to have them occupy in the finished plate; we then try them in the mouth to see if they are right; if satisfactory, we then lay the plate and teeth on the original cast or counter-part of the mouth; then the whole is buried with plaster in a cast-iron flask, in the lower part, and plaster is poured round it, so as to extend up to the edge of the gums, and then, when hardened, we take a brush and put on shellac to glaze the plaster, so that the new one will not adhere to it; the object of the plaster that has just been spoken of is to set the cast firmly in the flask, so as to hold the impression firmly in the flask when the wax plate has been removed, as will be described; we now proceed to form the top mould; we put on the top part of the flask, which consists of a kind of band, open at the top; then we pour soft plaster around the teeth, and fill the flask full of plaster; we then put the cover on, and lay a weight on until the plaster is hardened; we then open the flask in the middle; the teeth are now embedded in the plaster which has just been hardened; this leaves the original cast of the mouth in one-half and the teeth in the other; then we take the wax all off, removing it with hot water; then we cut away the plaster round the edge of the flask, so as to form a thin rim to serve as an outlet into which the surplus material can flow; then we select the piece of celluloid, according to the size of the intended plate, and then we put this in boiling water to soften it; then we lay in the flask on to the teeth and pins, and then we bring the top part and the bottom part of the flask together; and then we put them in our steam-boiler, as before described.

Examination adjourned to Friday, May 21st, 1875, at 10 a. m.

NEW YORK, *June 11th*, 1875—11 a. m.

Present, Mr. Schieffelin, counsel for defendant, and Mr. Lee, counsel for complainants.

102 Cross-examination of the witness Henry J. Fisk continued by Mr. LEE:

Cross ques. 59. Have you with you to-day the specimens of rose-pearl, celluloid, and pink vulcanite called for at the last meeting; and if yea, will you produce the same as exhibits?

Ans. I have them with me, and produce them.

They are put in evidence, marked, respectively, Exhibit Rose Pearl, Exhibit Celluloid, and Exhibit Pink Vulcanite.

Cross-ques. 60. The holes and the cavities in Exhibits Celluloid and

Rose Pearl are caused by the teeth and pins having been pulled out, are they not?

Ans. Yes, sir.

Cross-ques. 69. Did you keep a vulcanizer at Dr. Preterre's?

Ans. Yes, sir.

Cross ques. 70. Isn't it heated almost every day?

Ans. No, sir; in fact we can vulcanize in our celluloid apparatus.

Cross-ques. 71. Do you generally vulcanize in your celluloid apparatus?

Ans. No, sir.

Cross ques. 94. Which would be the most elastic of the same thickness, Exhibit Celluloid or Exhibit Rose Pearl?

Ans. I should think they would be about the same.

Cross-ques. 95. Exhibit Rose Pearl is an unfinished and spoiled case, isn't it?

Ans. Yes, sir.

Cross ques. 96. Exhibit Celluloid has the upper part of the porcelain tooth broken off by accident, hasn't it?

Ans. Yes, sir.

Cross ques. 97. The celluloid and rose pearl plates substantially resemble each other and are constructed substantially in the same manner, are they not?

Ans. Yes, sir.

Recross-ques. 104. Have you any objection, as these Exhibits Pink Vulcanite and Celluloid are rather dilapidated, to attaching a duplicate celluloid plate and also a duplicate vulcanite plate of dark vulcanite?

Ans. I have no objection, and will do so.

They are attached marked Exhibit Celluloid No. 2 and Exhibit Dark Rubber.

Recross-ques. 105. Exhibit Celluloid No. 2 has not been polished on the inside, has it?

103 Ans. No, sir; it has not been polished at all since it was repaired by putting the lighter piece of celluloid next to the front teeth.

HENRY J. FISK.

Sworn to before me this 11th June, 1875.

JOSEPH GUTMAN, JR.,
Examiner, &c.

Complainants' Exhibit A.

No. 43009.

The United States of America to all to whom these letters-patent shall come:

Whereas John A. Cummings, of Boston, Massachusetts, has alleged that he has invented a new and useful improvement in artificial gums and palates, which he states has not been known or used before his application; has made oath that he is a citizen of the United States; that he does verily believe that he is the original and first inventor or discoverer of said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty-five dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are, therefore, to grant, according to law, to the said John A. Cummings, his heirs, administrators, or assigns, for the term of seventeen years from the seventh day of June, one thousand eight hundred and sixty-four, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said John A. Cummings in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand, at the city of Washington, this seventh day of June, in the year of our Lord one thousand eight hundred and
104 sixty-four, and of the Independence of the United States of America the eighty-eighth.

J. P. USHER,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[L. S.] D. P. HOLLOWAY,
Commissioner of Patents.

The schedule referred to in these letters-patent, and making part of the same.

To all persons to whom these presents shall come:

Be it known that I, John A. Cummings, of Boston, in the county of Suffolk, and State of Massachusetts, have invented certain new and useful improvements in the manner of forming artificial palates and gums used for inserting artificial teeth; and that the following description, taken in connection with the accompanying drawings, hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said invention, by which it may be distinguished from others of a similar class, together with such parts as I claim and desire to have secured to me by letters-patent.

The figures of the accompanying plates of drawings represent my improvements.

Fig. 1 is a front elevation of a set of artificial teeth and plate formed by my improved method.

Fig. 2 is a view of the lower side of the plate and teeth.

Fig. 3 is a central vertical section of the same.

The method hitherto practiced of attaching artificial teeth to a metallic plate, fitting to the roof of the mouth, is attended with many objections and inconveniences, as the plate, being hard and unyielding, naturally hurts the mouth, and in some degree impedes mastication and perfect articulation, while the expense of the metal employed prevents many from availing themselves of the advantage of artificial teeth.

The present invention consists in forming the plate and gums, to which the teeth are attached, of rubber, or some other elastic material, so indurated as to be rigid enough for the purpose of mastication, and pliable enough to yield a little to the motions of the mouth, and
105 in one piece, the teeth being embedded in the elastic material while the said material is in a soft condition, and then baked with the gums and plate, so that the teeth, gums, and plate will all be connected, forming, as it were, one piece.

a a a, &c., in the drawings, represent the artificial teeth, prepared in the usual manner. The plate and gums *b b* are formed of one piece, and of rubber or of rubber and the compounds commonly employed

therewith, or of gutta-percha, or in fact of any elastic substance which can be reduced to a soft condition, and then vulcanized or hardened sufficiently to answer the purpose. The rubber or other material used is first molded to fit the shape of the mouth, and the gums formed, and, while soft and pliable, the teeth *a a* are imbedded in the gums, and, as an additional security, fastened to the same by small pins, *c c*, fig. 3. The teeth, gums, and plate, being thus connected, are then baked until the elastic material becomes sufficiently vulcanized, when the process is completed, the plate being hard and rigid enough for the purposes of mastication, and yet, by its elastic nature, yielding to the motions of the mouth, while the teeth are firmly embedded and secured in the gums.

The plate and gums can be colored in any proper manner to imitate nature.

Having thus described my improvements, I shall state my claim as follows:

What I claim as my invention, and desire to have secured to me by letters patent, is—

Forming the plate and gums in which the teeth are inserted in one piece of hard rubber, or vulcanite, i. e., an elastic material which can be hardened sufficiently for the purpose of mastication, and retain a portion of its elasticity so as to yield a little to the motion of the mouth, as herein set forth, and for the purposes specified.

JOHN A. CUMMINGS.

Witnesses:
A. POLLOK.
J. L. COOMBS.

Complainants' Exhibit B.

Liber M 7, p. 22.

Know all men by these presents that whereas I, John A. Cummings, of Boston, in the county of Suffolk, and State of Massachusetts, have invented certain new and useful improvements in rubber
106 palates, &c., for dentists' use, for which I am about to make application for letters patent of the United States; and whereas G. H. P. Flagg and H. D. Osgood, both of Boston, in the State aforesaid, are desirous of acquiring one undivided quarter part of all the property in the said new invention, and in any letters patent which may be granted, and have contracted with me for the purchase of the same:

Now, therefore, this indenture witnesseth that, in pursuance of said contract, and for and in consideration of the sum of one hundred dollars to me in hand paid by the said Flagg & Osgood, the receipt whereof is hereby acknowledged, I have assigned, sold, set over, and conveyed, and by these presents do assign, sell, set over, and convey unto the said Flagg & Osgood one undivided quarter part of all the property, of whatsoever nature, which I have in the aforesaid new invention, as fully set forth in the specification which I have prepared and executed preparatory to the obtaining of letters patent therefor.

In witness whereof I have hereunto set my hand and seal this first day of March, in the year eighteen hundred and sixty-four.

[L. S.] JOHN A. CUMMINGS.

Executed and delivered in presence of—
JOSEPH GAVETT.

[5c. 5c. J. A. C., March 1, '64. 5c. 5c.]

STATE OF MASSACHUSETTS,
County of Suffolk, ss:

Then personally appeared before me the above-named John A. Cummings, and acknowledged the foregoing instrument by him signed and sealed to be his free act and deed.

JOSEPH GAVETT,
Justice of the Peace.

Received and recorded June 18, 1864.
[5c. 5c. J. G., March 1, '64. 5c. 5c.]

Complainants' Exhibit C.

Liber G[1] 17, p. 14.

Know all men by these presents that whereas I, John A. Cummings, of Boston, in the county of Suffolk, and State of Massachu-
107 setts, have invented a new and useful rubber palate, for which I have made application for letters patent of the United States, and—

Whereas Joseph Gavett, of said Boston, is desirous of acquiring one undivided eighth part of all the property in the said new invention, and in any letters-patent which may be granted therefor, and has contracted with me for the purchase of the same:

Now, therefore, this indenture witnesseth, that, in pursuance of the said contract, and for and in consideration of the sum of one hundred dollars to me in hand paid by the said Joseph Gavett (the receipt whereof is hereby acknowledged), I have assigned, sold, set over and conveyed, and by these presents do assign, sell, set over and convey unto the said Joseph Gavett, one undivided eighth part of all the property, of whatsoever nature, which there is in the aforesaid new invention, as fully set forth in the specification which I have prepaid and executed preparatory to the obtaining of letters-patent therefor.

In witness whereof I have hereunto set my hand and seal this sixteenth day of May, in the year eighteen hundred and sixty-four.

[L. S.] JOHN A. CUMMINGS.

Executed and delivered in presence of—
SAMUEL M. BARTON.
Recorded Aug. 29, 1873.
[5c. 5c. 5c. 5c.]

Complainants' Exhibit D.

Liber O 7, p. 77.

Know all men by these presents that we, John A. Cummings, George H. P. Flagg, Herman D. Osgood, and Joseph Gavett, all of Boston, in the State of Massachusetts, in consideration of the sum of four hundred and eighty-eight thousand dollars, to us paid (and the receipt whereof is hereby acknowledged) by the Dental Vulcanite Company, a corporation established under the laws of the State of Massachusetts, do hereby sell, assign, transfer, and convey to the said company, its successors and assigns, certain letters-patent of the United States, and the inventions and improvements secured thereby, granted to the said Cummings, dated June 7th, 1864, and numbered 43009, and all improvements that have heretofore been made, or may hereafter be made, by any or

108 all of us, in the use of rubber or gutta-percha for dental purposes; to have and to hold the same to the said company, its successors and assigns, to its own use and behoof.

Witness our hands and seals this 30th day of July, A. D. 1864.

JOHN A. CUMMINGS. [L. S.]
G. H. P. FLAGG. [L. S.]
H. D. OSGOOD. [L. S.]
JOSEPH GAVETT. [L. S.]

[5. 5. July 20, 1864, J. A. C., G. H. P., W. C. O., J. G. 5. 5.]

In presence of—
GEO. S. HALE to J. A. C., G. H. P. F., and H. D. O.

SUFFOLK, *ss:*

BOSTON, 29 *July*, 1864.

Then personally appeared the above-named John A. Cummings, G. H. P. Flagg, H. D. Osgood, and Joseph Gavett, and severally acknowledged the foregoing instrument by them subscribed to be their free act and deed.

Before me,

EDWIN H. ABBOTT,
Justice of the Peace.

Rec'd and recor'd Aug. 5, '64.

[5. 5. E. H. A., July 29, 1864.]

Complainants' Exhibit E.

The undersigned hereby certify that a corporation has been formed under the laws of the commonwealth of Massachusetts; that its corporate name is "Dental Vulcanite Company;" that its purpose is the manufacture and sale of artificial gums and palates, of vulcanite or hard rubber, under letters patent granted John A. Cummings, dated June 7th, 1864, and assigned to the said corporation.

That the amount of capital stock of said corporation is five hundred thousand dollars; that the whole amount thereof has been paid in, in patent rights and cash, and that the par value of the shares is one hundred dollars each.

GEO. P. SANGER,
President.
JOSIAH BACON,
Treasurer.

[Stamp.]

JOHN A. CUMMINGS,
DAVID THAYER,
G. H. P. FLAGG,
JOSEPH GAVETT,
Majority of the Directors.

[Stamp.]

109 SUFFOLK, *ss:*

BOSTON, 1 *August*, 1864.

Then personally appeared the above named Geo. P. Sanger, Josiah Bacon, John A. Cummings, G. H. P. Flagg, Joseph Gavett, and David Thayer, and made oath that the foregoing certificate by them subscribed is true.

Before me,

EDWIN H. ABBOTT,
Justice of the Peace.

COMMONWEALTH OF MASSACHUSETTS,
SECRETARY'S DEPARTMENT,
BOSTON, *January* 11, 1875.

I hereby certify that the foregoing is a true copy of the certificate of organization of the Dental Vulcanite Company, on file and record in this department.

Witness the seal of the commonwealth.

[SEAL.] OLIVER WARNER,
Secretary of the Commonwealth.

UNITED STATES OF AMERICA:

By his excellency, William Gaston, governor of the commonwealth of Massachusetts:

It is hereby certified, that Hon. Oliver Warner was, on the day of the date of the annexed certificate, secretary of the commonwealth of Massachusetts, and duly authorized to grant the same; that the same is in due form and executed by the proper officer; that the seal affixed to said certificate is the seal of the commonwealth of Massachusetts; that the signature thereto of the said secretary of the commonwealth is in his proper handwriting, and is genuine, and that full faith and credit may and ought to be given to his official acts.

In testimony whereof the seal of the commonwealth is hereunto affixed.

Witness my hand, at the city of Boston, the eleventh day of January, in the year of our Lord one thousand eight hundred and seventy-five.

[SEAL.] WM. GASTON.

110 *Complainants' Exhibit F.*

Reissue No. 1848.

The United States of America to all to whom these letters-patent shall come:

Whereas John A. Cummings, of Boston, Massachusetts, (he having assigned his right, title, and interest in said improvement to the Dental Vulcanite Company of the same place,) has alleged that he has invented a new and useful improvement in artificial gums and palates, (for which letters patent were issued to him, dated June 7, 1864, which letters, having been surrendered by him, the same have been canceled and new letters ordered to issue to said Dental Vulcanite Company, on an amended specification,) which he states has not been known or used before his application; has made oath that he is a citizen of the Uni ed States; that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are, therefore, to grant, according to law, to the said Dental Vulcanite Company, their successors or assigns, for the term of seventeen years from the seventh day of June, one thousand eight hundred and sixty-four, the full and exclusive right and liberty of making, con-

structing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said John A. Cummings, in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand at the city of Washington, this tenth day of January, in the year of our Lord one thousand eight hundred and sixty-five, and of the Independence of the United States of America the eighty-ninth.

J. P. USHER,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[L. S.] D. P. HOLLOWAY,
Commissioner of Patents.

111 The schedule referred to in these letters patent, and making part of the same.

To all persons to whom these presents shall come:

Be it known that I, John A. Cummings, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful improvements in plates for artificial teeth, and that the following description, taken in connection with the accompanying plate of drawings hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said improvements by which my invention may be distinguished from all others of a similar class, together with such parts as I claim and desire to have secured to me by letters patent.

The method hitherto practiced of attaching artificial teeth to a metallic plate fitting to the roof of the mouth is attended with many objections and inconveniences, as the plate, being hard and unyielding, naturally hurts the mouth, and in some degree impedes mastication and perfect articulation, while the expense of the metal employed prevents many from availing themselves of the advantages of artificial teeth.

My present invention consists in forming the plate to which the teeth, or teeth and gums, are attached of hard rubber or vulcanite, so called, an elastic material, possessing and retaining in use a sufficient rigidity for the purpose of mastication, and at the same time being pliable enough to yield a little to the motions of the mouth.

My manner of making and using said hard rubber plates is as follows: A wax or plaster impression of that part of the mouth which the plate is to fit is first taken, and from the impression a plaster cast is made which will exactly resemble that part of the mouth from which the first impression was taken. A plate of wax of the general form of the intended rubber plate is then made from this plaster cast, and around the front of this wax plate a vertical ridge of wax is fixed in about the position which the teeth are to occupy, in the same manner as is generally practiced in the construction of gold plates for artificial teeth. A plaster mould is then made from this wax plate, fitting it both on the upper and under side, which plaster mould is known generally as the articulator, and is constructed so as to hold the wax plates securely and conveniently for manipulation, leaving the front edge, where the teeth are to be applied, exposed and accessible. The figures of the accompanying plate of drawings represent my improvements.

112 Fig. 1 is a front elevation of a set of artificial teeth and plate formed by my improved method.

Fig. 2 is a view of the lower side of the plate and teeth.

Fig. 3 is a central vertical section of the same. The teeth shown in the drawings are gum teeth, so called, i. e., having porcelain gums formed in one piece with the teeth and properly colored, and they are shown each one separate. But they may be without porcelain gums, in which case the palate and gums will be formed in one piece of hard rubber, and if gum-teeth, they may be formed in groups of two or more, as desired. My mode of operation is the same, whether gum teeth or teeth alone are used, or separate or in groups.

The teeth are set in place in the wax plate and adjusted to the proper distance and fullness in the same manner as is generally practiced in setting teeth in gold plates. In the drawings the gum-teeth are made separate, and marked *a*, *a*. The wax plate and gums with the teeth adhering thereto are now set upon the original plaster cast of the corresponding part of the mouth, and plaster is poured all around up to about the lower edge (as it lies) of the wax plate; the margin or outlying surface of plaster is oiled or varnished and plaster poured over the whole, forming a complete mould of the plate and teeth. Upon the opening of this mould the wax is warmed and removed so as to leave the teeth adhering in the plaster mould in exactly the relative position they are to occupy in the hard rubber plate.

The teeth are provided with pins, *c*, *c*, projecting therefrom in such manner that the rubber which is to constitute the plate will close around them, and by means of them hold or secure the teeth permanently in position. The plaster mould, with the teeth adhering therein, as just described, is now filled with soft rubber, a little at a time, pressed in with the finger, or in other convenient way; and care is to be taken that the rubber is made to completely fit into the cavities and around the protuberances (including the pins), and is filled in to the thickness or depth desired to form the plate. I then lock the rubber plate in position by shutting the other half of the plaster mould over it to insure its retaining its exact form while warming, and then heat or bake it in an oven, or in any other suitable way. The soft rubber or gum so inserted in the mould is to be compounded with sulphur, rubber, &c., in the manner prescribed in the patent of Nelson Goodyear, dated May 6th,

A. D. 1864, for making hard rubber, and is to be subjected to
113 sufficient heat to vulcanize or harden it, substantially as directed in that patent. It is also to be colored in imitation of the natural gum, by mixing it with vermillion or other suitable coloring matter while in the soft state. After the plate has been heated sufficiently to harden it or convert it into hard rubber or vulcanite, so called, the mould is removed, and the plate is polished ready for use.

Having thus described the method I have used for making and using said hard rubber or vulcanite plates, what I claim herein, and desire to secure by letters patent, is—

The plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth, or teeth and gums, substantially as described.

JOHN A. CUMMINGS.

JOSEPH GAVETT,
SAMUEL M. BARTON,
Witnesses.

Complainants' Exhibit G.

Reissue No. 1904.

The United States of America to all to whom these letters patent shall come:

Whereas John A. Cummings, of Boston, Massachusetts (he having assigned his right, title and interest in said improvement to the Dental Vulcanite Company of the same place), has alleged that he has invented a new and useful improvement in artificial gums and palate, for which letters patent were issued to him, dated June 7, 1864, (the same surrendered and new letters ordered to issue to the Dental Vulcanite Company, dated January 10, 1865; which second letters having been surrendered by them, the same have been cancelled, and new letters ordered to issue to them on an amended specification,) which he states has not been known or used before his application; has made oath that he is a citizen of the United States; that he does verily believe that he is the original and first inventor or discoverer of the said improvement; and that the same hath not, to the best of his knowledge and belief, been previously known or used; said assignees having paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

114 These are, therefore, to grant, according to law, to the said Dental Vulcanite Company, their successors or assigns, for the term of seventeen years, from the 7th day of June, one thousand eight hundred and sixty-four, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said John A. Cummings in the schedule hereunto annexed, and is made a part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand, at the city of Washington, this twenty-first day of March, in the year of our Lord one thousand eight hundred and sixty-five, and of the Independence of the United States of America the eighty-ninth.

J. P. USHER,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[L. S.] D. P. HOLLOWAY,
Commissioner of Patents.

The schedule referred to in these letters patent and making part of the same.

To all persons to whom these presents shall come:

Be it known that I, John A. Cummings, of Boston, in the county of Suffolk, and State of Massachusetts, have invented certain new and useful improvement in plates for artificial teeth; and that the following description, taken in connection with the accompanying plate of drawings, hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said im-

provements, by which my invention may be distinguished from all others of a similar class, together with such parts as I claim and desire to have secured to me by letters patent.

The method hitherto practiced of attaching artificial teeth to a metallic plate fitting to the roof of the mouth, is attended with many objections and inconveniences, as the plate being hard and unyielding, naturally hurts the mouth, and, in some degree, impedes mastication and perfect articulation; while the expense of the metal employed prevents many from availing themselves of the advantage of artificial teeth.

115 My present invention consists in forming the plate, to which the teeth or teeth and gums are attached, of hard rubber, or "vulcanite," so-called—an elastic material possessing and retaining in use sufficient rigidity for the purpose of mastication, and at the same time, being pliable enough to yield a little to the motions of the mouth.

My manner of making and using said hard-rubber plates is as follows: A wax or plaster impression of that part of the mouth which the plate is to fit is first taken, and from that impression a plaster cast is made, which will exactly resemble that part of the mouth from which the first impression was taken. A plate of wax of the general form of the intended rubber plate is then made from this plaster cast, and around the front of this wax plate a vertical ridge of wax is fixed, about in the position which the teeth are to occupy, in the same manner as is generally practised in the construction of gold plates for artificial teeth. A plaster mould is then made from this wax plate, fitting it both on the upper and under side, which plaster mould is known generally as the articulator, and is constructed so as to hold the wax plate securely and conveniently for manipulation, leaving the front edge, where the teeth are to be applied, exposed and accessible. The figure of the accompanying plate of drawings represent my improvements.

Fig. 1 is a front elevation of a set of artifical teeth and plate formed by my improved method.

Fig. 2 is a view of the lower side of the plate and teeth.

Fig 3 is a central vertical section of the same.

The teeth shown in the drawings are gum-teeth, so-called; that is, having porcelain gums formed in one piece with the teeth, and properly colored; and they are shown each one separate. But they may be without porcelain gums, in which case the palate and gums will be formed in one piece, of hard rubber, and if gum-teeth, they may be formed in groups of two or more as desired. My mode of operation is the same whether gum-teeth or teeth alone are used, or separate or in groups. The teeth are set in place in the wax plate and adjusted to the proper distance and fulness, in the same manner as is generally practiced in setting teeth in gold plates. In the drawing the gum-teeth are made separate, and marked *a*, *a*. The wax plate and gums, with the teeth adhering thereto, is now set upon the original plaster cast of the corresponding part of the mouth, and plaster is poured all round, up to about the lower edge (as it lies) of the wax plate. The margin, or out-

116 laying surface of plaster is oiled or varnished, and plaster poured over the whole, forming a complete mould of the plate and teeth. Upon the opening of this mould the wax is warmed and removed so as to leave the teeth adhering in the plaster mould in exactly the relative position they are to occupy in the hard-rubber plate. The teeth are provided with pins, *c c*, projecting therefrom in such manner that the rubber which is to constitute the plate will close around them, and by means of them hold or secure the teeth permanently in position. The

provements, by which my invention may be distinguished from all others of a similar class, together with such parts as I claim and desire to have secured to me by letters patent.

The method hitherto practiced of attaching artificial teeth to a metallic plate fitting to the roof of the mouth, is attended with many objections and inconveniences, as the plate being hard and unyielding, naturally hurts the mouth, and, in some degree, impedes mastication and perfect articulation; while the expense of the metal employed prevents many from availing themselves of the advantage of artificial teeth.

115 My present invention consists in forming the plate, to which the teeth or teeth and gums are attached, of hard rubber, or "vulcanite," so-called—an elastic material possessing and retaining in use sufficient rigidity for the purpose of mastication, and at the same time, being pliable enough to yield a little to the motions of the mouth.

My manner of making and using said hard-rubber plates is as follows: A wax or plaster impression of that part of the mouth which the plate is to fit is first taken, and from that impression a plaster cast is made, which will exactly resemble that part of the mouth from which the first impression was taken. A plate of wax of the general form of the intended rubber plate is then made from this plaster cast, and around the front of this wax plate a vertical ridge of wax is fixed, about in the position which the teeth are to occupy, in the same manner as is generally practised in the construction of gold plates for artificial teeth. A plaster mould is then made from this wax plate, fitting it both on the upper and under side, which plaster mould is known generally as the articulator, and is constructed so as to hold the wax plate securely and conveniently for manipulation, leaving the front edge, where the teeth are to be applied, exposed and accessible. The figure of the accompanying plate of drawings represent my improvements.

Fig. 1 is a front elevation of a set of artifical teeth and plate formed by my improved method.

Fig. 2 is a view of the lower side of the plate and teeth.

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The teeth shown in the drawings are gum-teeth, so-called; that is, having porcelain gums formed in one piece with the teeth, and properly colored; and they are shown each one separate. But they may be without porcelain gums, in which case the palate and gums will be formed in one piece, of hard rubber, and if gum-teeth, they may be formed in groups of two or more as desired. My mode of operation is the same whether gum-teeth or teeth alone are used, or separate or in groups. The teeth are set in place in the wax plate and adjusted to the proper distance and fulness, in the same manner as is generally practiced in setting teeth in gold plates. In the drawing the gum-teeth are made separate, and marked *a*, *a*. The wax plate and gums, with the teeth adhering thereto, is now set upon the original plaster cast of the corresponding part of the mouth, and plaster is poured all round, up to about the lower edge (as it lies) of the wax plate. The margin, or out-

116 laying surface of plaster is oiled or varnished, and plaster poured over the whole, forming a complete mould of the plate and teeth. Upon the opening of this mould the wax is warmed and removed so as to leave the teeth adhering in the plaster mould in exactly the relative position they are to occupy in the hard-rubber plate. The teeth are provided with pins, *c c*, projecting therefrom in such manner that the rubber which is to constitute the plate will close around them, and by means of them hold or secure the teeth permanently in position. The

plaster mould, with the teeth adhering therein, as just described, is now filled with soft rubber, a little at at time, pressed in with the finger, or in any other convenient way; and care is to be taken that the rubber is made to completely fit into the cavities and around the protuberances, including the pins, and is filled in to the thickness or depth desired to form the plate. I then lock the rubber plate in position by shutting the other half of the plaster mould over it, to insure its retaining its exact form while warming, and then heat or bake it in an oven, or in any other suitable way. The soft rubber or gum, so inserted in the mould, is to be compounded with sulphur, rubber, etc., in the manner prescribed in the patent of Nelson Goodyear, dated May 6, A. D. 1851, for making hard rubber, and is to be subjected to sufficient heat to vulcanize or harden it, substantially as directed in that patent. It is also to be colored in imitation of the natural gums, by mixing it with vermillion, or other suitable coloring matter, while in the soft state. After the plate has been heated sufficiently to harden it, or co'vert it into hard rubber or "vulcanite," so-called, the mould is removed, and the plate is polished, ready for use.

Having thus described the method I have used for making and using said hard rubber or vulcanite plates, what I claim herein, and desire to secure by letters-patent is—

The plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth, or teeth and gums, substantially as described.

JOHN A. CUMMINGS.

JOSEPH GAVETT,
SAMUEL M. BARTON,
Witnesses.

117 *Complainants' Exhibit H.*

Assignment Dental Vulcanite Company to Josiah Bacon.

Know all men by these presents, that the Dental Vulcanite Company, a corporation duly organized under the general laws of Massachusetts, in consideration of five hundred thousand dollars to them paid by Josiah Bacon, of Boston, have sold, transferred, and assigned, and by these presents do sell, transfer, and assign to Josiah Bacon, his heirs, administrators, and assigns, the letters-patent of the United States, which were issued to the Dental Vulcanite Company, assignees of John A Cummings, for an "Improvement in artificial gums and palates," said letters-patent bearing date March 21, 1865, and being numbered "Reissue No. 1904:" To have and to hold said letters-patent, the invention therein described, and the rights and privileges thereby secured and granted to him, the said Bacon, his heirs, administrators, and assigns, during the full term of said letters-patent, and all reissues and extensions thereof; and for the consideration aforesaid, the Dental Vulcanite Company hereby convey to said Bacon, all rights which they may have to commence actions for damages for infringements upon said letters-patent, with the right to use the name of said company in all such actions; and they do also assign and convey to said Bacon all licenses and agreements for the use of said invention which they have executed, with the right to collect all amounts now due, or which may become due, for the use of said letters-patent or invention, under all such licenses or agreements.

In witness whereof the Dental Vulcanite Company have caused their corporate seal to be hereto affixed, and these presents to be subscribed

by George P. Sanger, their president, who is duly authorized thereto, by a vote of this corporation, this seventeenth day of July, 1866.

[L. S.] (Signed) GEORGE P. SANGER,
President.

Signed, sealed, and delivered in presence of—
GEORGE P. WHEELER. [SEAL.]

Complainants' Exhibit I.

Assignment of Josiah Bacon to Goodyear Dental Vulcanite Company.

Whereas letters-patent of the United States were granted to John A. Cummings, bearing date June 7, 1864, for an improvement in artificial gums and palates, and were afterwards assigned to the
118 Dental Vulcanite Company, a corporation established by law of the commonwealth of Massachusetts, and the said Dental Vulcanite Company, assignees, obtained a reissue of said letters-patent, dated January 10, 1865, and afterwards a reissue of said reissue, dated March 21, 1865, and did, on or about the 17th day of July, A. D. 1866, by its deed of assignment of that date, sell and assign to Josiah Bacon, of Brookline, in said Massachusetts, (therein described as of Boston, in said Massachusetts,) and to his heirs, administrators, and assigns, the said reissue patent of March 21, 1865, and all the rights and privileges thereby secured and granted; and also all rights which the said company then had to damages for infringements upon said letters-patent, with the right to use the name of the said company in all actions for the recovery thereof, and did also assign and convey to said Bacon all licenses and agreements for the use of said invention which they, the said company, had then executed, with the right to collect all amounts then due, or which should thereafter become due, for the use of said letters patent or invention under all such licenses or agreements:

Now I, the said Josiah Bacon, for and in consideration of the sum of one dollar to me paid by the Goodyear Dental Vulcanite Company, a corporation duly organized and established under the laws of the State of New York, have assigned and sold, and do hereby assign and sell, unto the said Goodyear Dental Vulcanite Company, its successors and assigns, all my right, title, and interest as aforesaid, in the said reissue patent of March 21, 1865, and all the other rights and interests to me conveyed as aforesaid, and also the right to demand, sue for, and collect to its, the said company's, own use, (but in my name if necessary,) all damages and profits due at law and in equity for infringements of said reissue, committed since July 17, 1866, and all monies due or to become due under any and all licenses to use said invention which have been executed since said July 17, 1866, and also the right to prosecute to final issue the suits now pending in equity in my name for infringements of said letters patent, and the right to all interlocutory remedies in said suits and to the monies to be therein recovered.

Witness my hand and seal the seventh day of January, anno Domini one thousand eight hundred and sixty-eight.

JOSIAH BACON.

Witness:
A. POLLOK.

Recorded March 4, 1868.

119 *Complainants' Exhibit J.*

Certificate of incorporation.

STATE OF NEW YORK,
County of New York, City of New York:

We, the undersigned, John H. Cheever, Charles Goodyear, jr., Charles L. Richards, and John Ashton Greene, do hereby certify that we desire to form a company pursuant to the provisions of an act entitled "An act to authorize the formation of corporations for manufacturing, mining, mechanical, or chemical purposes," passed February 17th, 1848, and of the several acts extending and amending the same. That the corporate name of said company is to be the Goodyear Dental Vulcanite Company, and the objects for which said company is to be formed are to manufacture and vend the hard compound of vulcanized caoutchouc or India rubber and allied gums, so far as the same is applied to dental purposes or dentistry, and for the purpose of manufacturing and selling artificial gums, plates, and palates, made from said hard compound.

That the amount of the capital stock of said company is to be fifteen hundred thousand dollars; that the term of existence of said company is to be fifty years; that the number of shares of which said stock is to consist is to be fifteen thousand; that the number of trustees who shall manage the concerns of said company for the first year is seven; that the names of said trustees are Charles Goodyear, jr., John H. Cheever, Chas. L. Richards, John Ashton Greene, John A. Cummings, Henry Souther, and Charles J. Morrill; that the names of the towns and counties in which the operations of the said company are to be carried on are, Boston, Massachusetts, county of Suffolk, where the business of the company is to be carried on, and the city of New York, county of New York, where the principal part of the business of the company within this State is to be transacted.

New York, Dec. 18th, 1867.

JOHN H. CHEEVER. [L. S.]
CHAS. GOODYEAR, JR. [L. S.]
CHAS. L. RICHARDS. [L. S.]
JOHN ASHTON GREENE. [L. S.]

120 DEC. 18TH, 1867.

CITY, COUNTY, AND STATE OF NEW YORK:

Then personally appeared the within-named John H. Cheever, Charles Goodyear, Charles L. Richards, and John Ashton Greene, and acknowledged the foregoing certificate by them subscribed to be their free act and deed.

Before me.

[L. S.] M. M. LIVINGSTON,
Notary Public, City, County, and State of New York.

(Endorsed:) Filed December 19, 1867.

STATE OF NEW YORK,
City and County of New York, ss:

I, William C. Conner, clerk of the said city and county, and clerk of the supreme court of said State for said county, do certify that I have compared the preceding with the original certificate of incorporation of the "Goodyear Dental Vulcanite Company," on file in my office, and

that the same is a correct transcript therefrom and of the whole of such original.

In witness whereof I have hereunto subscribed my name and affixed my official seal this 19th day of December, 1867.

[L. S.] WM. C. CONNER,
Clerk.

[5c. int. rev. stamp, canceled.]

(Endorsed:) Filed Dec. 21, 1867. Erastus Clark, deputy secretary of State.

STATE OF NEW YORK,
Office of the Secretary of State, ss:

I have compared the preceding with the duplicate original certificate of incorporation of the Goodyear Dental Vulcanite Company, with acknowledgment thereto annexed, filed in this office on the twenty-first day of December, 1867, and hereby certify the same to be a correct transcript therefrom and of the whole of said duplicate original.

Witness my hand and seal of office of the secretary of state, at the city of Albany, this tenth day of September, one thousand eight hundred and seventy-three.

[L. S.] ANSON S. WOOD,
Dep. Secretary of State.

121 UNITED STATES OF AMERICA:

By John A. Dix, governor of the State of New York:

It is hereby certified that Anson S. Wood was, on the day of the date of the annexed certificate, deputy secretary of state of the State of New York, and duly authorized to grant the same; that the same is in due form, and executed by the proper officer; that the seal affixed to said certificate is the seal of office of secretary of state of the State of New York; that the signature thereto of the said deputy secretary of state is in his proper handwriting, and is genuine, and that full faith and credit may and ought to be given to his official acts.

In testimony whereof the great seal of the State is hereunto affixed.

Witness my hand at the city of Albany, the tenth day of September, in the year of our Lord one thousand eight hundred and seventy-three.

JOHN A. DIX.

Passed the secretary's office, the 10th day of September, 1873.

[L. S.] ANSON S. WOOD,
Dep. Secretary of State.

Complainants' Exhibit K.

No. 105338.

The United States of America to all to whom these letters patent shall come:

Whereas John W. Hyatt, jr., and Isaiah S. Hyatt, of Albany, New York, have alleged that they have invented a new and useful improvement in treating and molding pyroxyline, and have made oath that they are citizens of the United States, that they verily believe they are the original and first inventors or discoverers of the said improvement, and that the same hath not to their knowledge and belief been previously

known or used; have paid into the Treasury of the United States the sum of thirty-five dollars, and presented a petition to the Commissioner of Patents, praying that a patent may be issued therefor:

122 These are therefore to grant to the said Hyatt, jr., and Hyatt, their executors, administrators, or assigns, for the term of seventeen years from the twelfth day of July, one thousand eight hundred and seventy, the full and exclusive right and liberty of making, using, and vending to others to be used, the said improvement, a description whereof is given in the annexed schedule, and made a part of these presents.

In testimony whereof I have caused these letters to be made patent and the seal of the Patent Office to be hereunto affixed.

Given under my hand, at the city of Washington, this twelfth day of July, in the year of our Lord one thousand eight hundred and seventy, and of the Independence of the United States of America the ninety-fifth.

W. T. OTTO,
Acting Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.

[L. S.] SAM'L S. FISHER,
Commissioner of Patents.

UNITED STATES PATENT OFFICE.

John W. Hyatt, jr., and Isaiah S. Hyatt, of Albany, New York. Improvement in treating and molding pyroxyline.

Specification forming part of letters patent No. 105338, dated July 12th, 1870.

We, John W. Hyatt, jr., and Isaiah S. Hyatt, both of Albany, in the county of Albany and State of New York, have invented a new and improved process of dissolving pyroxyline and of making solid collodion, of which the following is a specification:

Our invention consists, first, of so preparing pyroxyline that pigments and other substances in a powdered condition can be easily and thoroughly mixed therewith before the pyroxyline is subjected to the action of a solvent; secondly, of mixing with the pyroxyline so prepared, any desirable pigment, coloring matter, or other material, and also any substance in a powdered state which may be vaporized or liquified and converted into a solvent of pyroxyline by the application of heat;

123 and, thirdly, of subjecting the compound so made to heavy pressure while heated, so that the least practicable proportion of solvent may be used in the production of solid collodion and its compounds.

The following is a description of our process:

First, we prepare the pyroxyline by grinding it in water until it is reduced to a fine pulp, by means of a machine similar to those employed in grinding paper pulp. Second, any suitable white or coloring pigment or dyes, when desired, are then mixed and thoroughly ground with the pyroxyline pulp, or any powdered or granulated material is incorporated that may be adapted to the purpose of the manufacture. While the ground pulp is still wet, we mix therewith finely pulverized gum-camphor in about the proportions of one part, by weight, of the camphor, to two parts of the pyroxyline when in a dry state. These proportions

may be somewhat varied with good results. The gum-camphor may be comminuted by grinding in water, by pounding, or rolling; or, if preferred, the camphor may be dissolved in alcohol or spirits of wine and then precipitated by adding water, the alcohol leaving the camphor and uniting with the water, when both the alcohol and the water may be drawn off, leaving the camphor in a very finely-divided state. After the powdered camphor is thoroughly mixed with the wet pyroxyline pulp and the other ingredients, we expel the water as far as possible by straining the mixture and subjecting it to an immense pressure in a perforated vessel. This leaves the mixture in a comparatively solid and dry state, but containing sufficient moisture to prevent the pyroxyline from burning or exploding during the remaining process. Third, the mixture is then placed in a mold of any appropriate form, which is heated by steam or by any convenient method to from 150° to 300° Fahrenheit, to suit the proportion of camphor and the size of the mass, and is subjected to a heavy pressure in a hydraulic or other press. The heat, according to the degree used, vaporizes or liquifies the camphor, and thus converts it into a solvent of the pyroxyline. By introducing the solvent in the manner here described, and using heat to make the solvent active and pressure to force it into intimate contact with every particle of the pyroxyline, we are able to use a less proportion of this or any solvent which depends upon heat for its activity than has ever been known heretofore. After keeping the mixture under heat and pressure long enough to complete the solvent action throughout the mass, it is cooled while still under pressure, and then taken out of the mold. The product
124 is a solid about the consistency of sole-leather, but which subsequently becomes as hard as horn or bone by the evaporation of the camphor. Before the camphor is evaporated, the material is easily softened by heat, and may be molded into any desirable form, which neither changes nor appreciably shrinks in hardening.

We are aware that camphor made into a solution with alcohol or other solvents of camphor has been used in a liquid state as a solvent of xyloidine. Such use of camphor as a solvent of pyroxyline we disclaim.

Claims.

We claim as our invention—

1. Grinding pyroxyline into a pulp, as and for the purpose described.
2. The use of finely comminuted camphor-gum mixed with pyroxyline pulp, and rendered a solvent thereof by the application of heat, substantially as described.
3. In conjunction with such use of camphor-gum, the employment of pressure and continuing the same until the mold and contents are cooled, substantially as described.

JOHN W. HYATT, JR.
ISAIAH S. HYATT.

Witnesses:
WM. H. SLINGERLAND,
C. M. HYATT.

Complainants' Exhibit L.

No. 121522.

The United States of America to all to whom these presents shall come:

Whereas John W. Hyatt, jr., and Isaiah S. Hyatt, of Albany, New

York, have presented to the Commissioner of Patents a petition praying for the grant of letters patent for an alleged new and useful improvement in apparatus for moulding dental plates (they having assigned their right, title, and interest in said improvement to Albany Dental Plate Company), a description of which invention is contained in the specification of which a copy is hereunto annexed and made a part hereof *of*, and have complied with the various requirements of
125 law in such cases made and provided; and whereas, upon due examination made, the said claimants are adjudged to be justly entitled to a patent under the law:

Now, therefore, these letters patent are to grant unto the said Albany Dental Plate Company, its successors or assigns, for the term of seventeen years from the fifth day of December, one thousand eight hundred and seventy-one, the exclusive right to make, use, and vend the said invention throughout the United States and the Territories thereof.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the city of Washington, this fifth day of December, in the year of our Lord one thousand eight hundred and seventy-one, and of the Independence of the United States of America the ninety-sixth.

B. R. COWEN,
Acting Secretary of the Interior.

Countersigned.
[L. S.]

M. D. LEGGETT,
Commissioner of Patents.

121522.

UNITED STATES PATENT OFFICE.

John W. Hyatt, jr., and Isaiah Smith Hyatt, of Albany, New York, assignors to Albany Dental Plate Company. Improvement in apparatus for molding dental plates.

Specification forming part of letters patent No. 121522, dated December 5, 1871.

To all whom it may concern:

Be it known that we, John W. Hyatt, jr., and Isaiah Smith Hyatt, of the city and county of Albany and State of New York, have invented an improved apparatus for molding dental plates, of which the following is a specification:

Our invention relates to certain improvements in apparatus employed in the manufacture of sets of artificial teeth from collodion plates, produced according to the improved process described in letters patent No. 113055, and dated March 28, 1871, to which reference is here made for a description thereof.

126 In making a set of artificial teeth according to this process, the prepared plates are placed within the flask and heated to the temperature of about 300° Fahrenheit, which is most conveniently effected by placing the flask and clamp in a vessel containing oil and bringing the same to the required temperature, which softens and renders plastic the plate so as to enable it to be properly molded and attached to the teeth.

First, our invention consists of a flask-clamp, and a heating vessel constructed of a form in horizontal section corresponding more or less

nearly with the base of the clamp so as to receive the same and hold it against turning, while it at the same time enables a small quantity of oil to suffice for the purpose of heating the flask, thereby expediting the latter process; second, of a recess cast with the oil-reservoir, and partially separated from the interior of the tank by projecting flanges so as to form a convenient receptacle for a thermometer, by which the temperature of the liquid is determined.

In the accompany drawing, Figure 1 is a sectional elevation of our improved apparatus. Fig. 2 is a similar view at right angles to Fig. 1. Fig. 3 is a plan view.

A is the flask clamp, of ordinary construction, consisting of an oval base-plate, *a*, upright frame, a_1, screw a^2, operated by handle a^3. B is a flask of any suitable construction, in which the plates are molded. C is the oil-tank or reservoir, cast substantially of the form shown in Fig. 3, *c* being recesses at opposite sides to receive the ends of the press or clamps. D is a recess cast on one side of this vessel, and *d d* flanges projecting inward so as to partially shut off this recess from the interior of the vessel. E is a thermometer, represented and arranged in this recess. *f f* are legs by which the oil-tank is secured to the table, and supported above the same so as to permit of the arrangement of a lamp or gas-jet thereunder, by which the oil is heated. The construction of the vessel C, as just described, enables the clamp to be readily inserted and removed therefrom, while its form, corresponding with the base of the clamp, is such as to securely hold it against turning while the screw is being turned down in forcing the flask together. The base of the clamp fitting close within the vessel enables a smaller quantity of oil (which is sooner heated) to be used than would be required if the vessel were differently constructed. The recess forms a convenient receptacle for the thermometer, while the flanges *d* retain it in place.

127 What we claim as our invention is—

1. The arrangement, with the flask-press A, of the heating vessel C cast with recesses *c* or equivalent construction to receive and hold the press against turning, substantially as hereinbefore set forth.

2. The recess D and flanges *d* cast with the flask-heating vessel A, and forming a receptacle for the thermometer, as hereinbefore set forth.

JOHN W. HYATT, JR.
ISAIAH S. HYATT.

Witnesses:
J. G. JARVIS.
WM. S. SHEPARD.

Complainants' Exhibit M.

No. 152232.

The United States of America to all to whom these presents shall come:

Whereas I. Smith Hyatt and John W. Hyatt, of Newark, N. J., have presented to the Commissioner of Patents a petition praying for the grant of letters-patent for an alleged new and useful improvement in apparatus and processes for molding celluloids and the compounds of pyroxyline (they having assigned their right, title, and interest in the said improvement to the Celluloid Manufacturing Company, of same place), a description of which invention is contained in the specification of which a copy is hereunto annexed and made a part hereof, and have complied with the various requirements of law in such cases made and provided;

and whereas, upon due examination made, the said claimants are adjudged to be justly entitled to a patent under the laws:

Now, therefore, these letters-patent are to grant unto the said The Celluloid Manufacturing Company, its successors or assigns, for the term of seventeen years from the twenty-third day of June, one thousand eight hundred and seventy-four, the exclusive right to make, use and vend the same invention throughout the United States and the Territories thereof.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the city of Washington,
128 this twenty-third day of June, in the year of our Lord one thousand eight hundred and seventy-four, and of the Independence of the United States of America the ninety-eighth.

B. R. COWEN,
Acting Secretary of the Interior.

Countersigned. M. D. LEGGETT,
[L. S.] *Commissioner of Patents.*

UNITED STATES PATENT OFFICE.

I. Smith Hyatt and John W. Hyatt, of Newark, New Jersey, assignors to The Celluloid Manufacturing Company, of same place. Improvement in apparatus and processes for molding celluloids and the compounds of pyrox'line.

Specification forming part of letters-patent No. 152232, dated June 23, 1874; application filed May 25, 1874.

To all whom it may concern:

Be it known that we, I. Smith Hyatt and John W. Hyatt, of Newark, in the county of Essex, and State of New Jersey, have invented certain improvements in apparatus and process for moulding cellu'oid and the compounds of pyrox'line, of which the following is a specification:

Our invention relates to the treatment of such compounds of converted vegetable fibres as become plastic under heat, so as to permit the same to be molded when in that state, and especially "celluloid," which is a term used as a trade-mark, and applied to a compound produced and manufactured under letters-patent Nos. 105338, 113055, 133229, and dated respectively July 12, 1870, March 28, 1871, and November 19, 1872.

The inflammable nature of this material, and the ordinary compounds of pyrox'line, when raised to too high a degree of heat, in connection with other peculiar qualities, distinguish these compounds from others, so as to require in the molding of articles therefrom a more or less special manipulation thereof.

The molding of these compounds, or such of them as become plastic under heat, has heretofore been accomplished by placing the ma-
129 terial in molds (usually metallic), and then heating the molds in an oven, or on steam tables, whereby the material is subjected to a dry heat.

The first part of our invention consists in subjecting the material, in porous or other suitable moulds, to the direct action of steam, which not only heats and softens the mass with great facility, but, by excluding the heated air therefrom, and immersing the material in steam, diminishes to a great degree the liability of combustion taking place, while it absorbs more or less of the volatile solvents remaining in the material.

and whereas, upon due examination made, the said claimants are adjudged to be justly entitled to a patent under the laws:

Now, therefore, these letters-patent are to grant unto the said The Celluloid Manufacturing Company, its successors or assigns, for the term of seventeen years from the twenty-third day of June, one thousand eight hundred and seventy-four, the exclusive right to make, use and vend the same invention throughout the United States and the Territories thereof.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the city of Washington,
128 this twenty-third day of June, in the year of our Lord one thousand eight hundred and seventy-four, and of the Independence of the United States of America the ninety-eighth.

B. R. COWEN,
Acting Secretary of the Interior.

Countersigned. M. D. LEGGETT,
[L. S.] *Commissioner of Patents.*

UNITED STATES PATENT OFFICE.

I. Smith Hyatt and John W. Hyatt, of Newark, New Jersey, assignors to The Celluloid Manufacturing Company, of same place. Improvement in apparatus and processes for molding celluloids and the compounds of pyrox'line.

Specification forming part of letters-patent No. 152232, dated June 23, 1874; application filed May 25, 1874.

To all whom it may concern:

Be it known that we, I. Smith Hyatt and John W. Hyatt, of Newark, in the county of Essex, and State of New Jersey, have invented certain improvements in apparatus and process for moulding cellu'oid and the compounds of pyrox'line, of which the following is a specification:

Our invention relates to the treatment of such compounds of converted vegetable fibres as become plastic under heat, so as to permit the same to be molded when in that state, and especially "celluloid," which is a term used as a trade-mark, and applied to a compound produced and manufactured under letters-patent Nos. 105338, 113055, 133-229, and dated respectively July 12, 1870, March 28, 1871, and November 19, 1872.

The inflammable nature of this material, and the ordinary compounds of pyrox'line, when raised to too high a degree of heat, in connection with other peculiar qualities, distinguish these compounds from others, so as to require in the molding of articles therefrom a more or less special manipulation thereof.

The molding of these compounds, or such of them as become plastic under heat, has heretofore been accomplished by placing the ma-
129 terial in molds (usually metallic), and then heating the molds in an oven, or on steam tables, whereby the material is subjected to a dry heat.

The first part of our invention consists in subjecting the material, in porous or other suitable moulds, to the direct action of steam, which not only heats and softens the mass with great facility, but, by excluding the heated air therefrom, and immersing the material in steam, diminishes to a great degree the liability of combustion taking place, while it absorbs more or less of the volatile solvents remaining in the material.

The second part of our invention consists in molding celluloid and the compounds of pyroxyline in a closed vessel supplied with steam in contact with the molds and material, and provided with a safety-valve, so adjusted as to automatically regulate the pressure and temperature within the vessel, thereby dispensing with the use of the thermometer and preventing the overheating of the material, and also preventing the bursting of the vessel, in case combustion should from any cause ensue, by the means provided for the escap of the gases resulting therefrom. The third part of our invention consists in the combination, with the vessel in which the molds are placed, of a heater arranged under the same, and provided with an open receptacle for the heating liquid, and apertures for the admission of air to support combustion, the whole being constructed as herein described.

In the accompanying drawings, Figure 1 is a vertical section of an apparatus adapted for molding plates and other small articles. Fig. 2 is a top plan view of the hearer.

Like letters of reference designate like parts in each of the figures.

A is the heater, consisting of a suitable base, a, for supporting and securing the heater to a bed or table. The cup a^1 for holding the alcohol or other heating liquid, and the shield a_2 for inclosing the bottom or lower portion of the steam or other vessel B, in which the molds and material are heated, all cast together in one piece. a^3 are apertures, for the admission of air above the cup, the air being admitted under the base in any suitable manner. The shield a^2 is provided with vertical grooves a^4 in its inner surface to receive the lugs b on the vessel B, by which the latter is supported at the proper height and prevented from turning in the heater. C is a screw-cap or cover for the vessel B, provided with a sleeve, D, having a screw-cap, d, and stuffing-box d^1 through which passes the screw E, which works in a thread on the inside of the sleeve D. The lower end of this screw is provided with a cylindrical socket in which it fits, and by which the upper end of the platen or plunger F, by which the molds properly supported in the vessel B are forced together. G is a safety-valve, which may be of any suitable construction, adjusted to sustain such a pressure of steam as will correspond with the temperature required in the vessel. The temperature required will vary somewhat according to the quality and condition of material. The more thoroughly seasoned or dried the material the greater the temperature required.

For moulding celluloid this temperature ranges from 212° to 300° Fahrenheit, and, consequently, requires a pressure of from that of the atmosphere to sixty-four pounds above.

The material to be molded is placed within the molds until softened, when the molds are gradually forced together in the ordinary manner.

What we claim as our invention is—

1. Subjecting celluloid and the compounds of pyrox'line, placed in porous or other suitable molds, to the action of steam applied in direct contact therewith during the molding process, substantially as and for the purpose hereinbefore set forth.

2. Molding celluloid and the compounds of pyrox'line in a closed vessel supplied with steam, and provided with a safety-valve adjusted to automatically regulate the pressure and the temperature within the vessel, substantially as and for the purpose hereinbefore set forth.

3. The combination, with the heating-vessel, of the heater A, provi-

ded with cup a^1 and air-apertures a^3, as and for the purpose herein shown and described.

I. SMITH HYATT.
JOHN W. HYATT.

Witnesses to both signatures:
M. C. LEFFERTS.
S. M. THOMPSON.

131 EVIDENCE FOR COMPLAINANTS IN REPLY.

132 *Stipulation.*

NEW YORK, *August* 15, 1876—11 a. m.

Present, Henry Baldwin, jr., and E. Luther Hamilton, esqs., of counsel for defendants; and Edward N. Dickerson and Benjamin F. Lee, esqs., of counsel for complainants.

To save time and expense it is agreed that either party may offer and put in evidence printed copies of any depositions or documentary exhibits, from the record of the case of the Goodyear Dental Vulcanite Company and Josiah Bacon against Daniel H. Smith, in the United States circuit court for the district of Massachusetts, without further proof, and such copies shall be taken and used as parts of the record in this case the same as if regularly taken and proved herein.

(Defendants' record, page 44.)

(See page 226.)

133 Depositions of Flagg, Wilbur, Thayer, Mrs. Cummings, Bacon, Pollock, Rushmore, and Randall, from record in the suit of Goodyear Dental Vulcanite Co. et al. *vs.* Smith.

Deposition of George H. P. Flagg.

Direct examination by BENJAMIN F. LEE, esq., of counsel for complainants:

Int. 1. What is your name, age, residence, and occupation?

Ans. George H. P. Flagg; forty-three; Boston; dentist.

Int. 2. How long have you been engaged in the practice of dentistry?

Ans. Twenty-four years.

Int. 3. Did you know Dr. John A. Cummings, of Boston, to whom a patent was issued on June 7, 1864, for an improvement in artificial gums and palates; and, if yea, for how long a period?

Ans. I did; since 1845 until 1870, the date of his death.

Int. 4. What were your relations with Dr. Cummings? State if they were friendly, business, or otherwise.

Ans. From 1845 to 1855 it was merely friendly; from 1855 to 1860 I was in partnership with him; after 1860 to 1870, friendly.

Int. 5. During any part of this time, were you in a position to know his pecuniary circumstances? and, if yea, state your means of knowledge.

Ans. I was; by keeping his books from 1855 to 1860.

Int. 6. What was his pecuniary condition in 1860?

Ans. He was insolvent.

Int. 7. What arrangement was made, if any, between you and Dr. Cummings with regard to the practice of dentistry when the partnership ceased in 1860?

Ans. He was not to practice dentistry for five years within five miles of Boston.

134 Int. 8. State whether there was any subsequent arrangement between you and Dr. Cummings whereby he resumed the practice of dentistry; and, if yea, state what such arrangement was.

Ans. There was. He wished to be released from this agreement. He wanted to know upon what terms I would release him. I asked him to make me an offer. He said he could not afford to make me any offer that would pay me, as he was very poor, and should have to borrow the money. After a good deal of conversation, he made me an offer of one hundred ($100) dollars, which I accepted, remarking that he would have to go and borrow it. In a day or two he returned with the one hundred dollars, saying that he had borrowed it of a friend. This was about 1861.

Int. 9. After Dr. Cummings arranged with you to get leave to resume practice of dentistry in Boston, what did he do?

Ans. Asked me if I knew of any room he could hire or rent. I told him that my partner, Dr. Osgood, had the refusal of rooms next door to us, and I thought I could get him to give the refusal up to him, which he did.

Int. 10. Did he resume practice?

Ans. He did.

Int. 11. How long did he continue in the practice of dentistry?

Ans. About a year. He failed in business in that time.

Int. 12. Please state in what position (pecuniary) Dr. Cummings was, from 1860 until the time when he obtained his patent, and state all your means of knowledge and information on the subject, and all the circumstances relating thereto.

Ans. He was growing worse and worse, pecuniarily. My means of knowledge was what Dr. Cummings told me from time to time, and from what his creditors told me.

Int. 13. What family had Dr. Cummings at that time?

Ans. Wife and daughter.

Int. 14. In 1859 was Dr. Cummings in a prosperous pecuniary condition?

(Objected to as leading. Int. 14 is withdrawn by counsel.)

Int. 14. Please state what was Dr. Cummings's pecuniary condition in 1859.

Ans. He was insolvent.

Int. 15. After the year 1856 did Dr. Cummings ever speak to you of an application he had made for a patent for his invention relating to the hard-rubber dental plates?

135 Ans. He did, frequently.

Int. 16. What was the general purport of his remarks on this subject?

(Objected to as incompetent, and because such remarks at such time are not relevant.)

Ans. That the patent belonged to him, and he thought Mr. Lincoln was very neglectful in not procuring the patent.

Int.. 17. How frequently did he make such remarks?

(Same objection.)

Ans. Very often; I might say weekly.

Int. 18. Who was the Mr. Lincoln referred to in your last answer?

Ans. Dr. Cummings's solicitor. His name was Ezra Lincoln.

Int. 19. Is Ezra Lincoln now living?

Ans. He is not.

Int. 20. Did Dr. Cummings ever apply to you to advance him any money; and, if yea, when and for what purpose?

Ans. He did, through Mr. Randall, in 1864, for the purpose of procuring his patent.

Int. 21. Did you advance him the money asked for; and, if so, on what terms?

Ans. I did; and if the patent was procured, my partner, Dr. Osgood, and myself were to have one-eighth part each.

Int. 22. How much did you advance him?

Ans. One hundred dollars first; afterward, seven hundred dollars; then twenty dollars after the patent was allowed.

Int. 23. Was the twenty dollars that you have spoken of provided for in your original understanding with Dr. Cummings?

(Objected to.)

Ans. It was not.

Int. 24. How, then, did you come to advance it?

Ans. He came and told me that the patent was allowed; that there was twenty dollars to be paid, and wished me to pay it, saying that he had not money enough to pay even that small amount.

(Answer objected to by counsel for defendant as incompetent and irrelevant.)

Int. 25. What was the condition of Dr. Cummings's health in the year 1859, and from that onward?

Ans. It was poor; he was suffering from a scrofulous disease.

Int. 26. State, if you please, what was the cause of Dr. Cummings's decay in prosperity during the period you have mentioned, from 1859 onward.

136 Ans. From ill-health; and another great cause was this hobby, this rubber claim of his.

Int. 27. Please state what effect, if any, his disease had upon his capacity to successfully practice dentistry.

Ans. It made him nervous, irritable, suffering such pain most of the time.

Int. 28. How did that interfere with his practice of dentistry?

Ans. By being in such acute pain most of the time.

Int. 29. How did his being in acute pain interfere with his practising dentistry?

Ans. A man in acute pain is incapacitated from any such business as that.

Int. 30. Prior to 1859 was Dr. Cummings in prosperous pecuniary circumstances?

Ans. He was, up to 1859. That don't answer it right. It is hard for me to say from the time we were in partnership in 1855 to 1859, when he became insolvent.

Int. 31. Between 1855 and 1859 were his pecuniary affairs progressing prosperously?

Ans. He was in a more prosperous condition the first year or two than he was the last year or two.

Int. 32. Please state the time when, as nearly as you can, and the place where, and the circumstances under which you first had knowledge of Dr. Cummings's invention of hard-rubber plates or bases for artificial teeth.

Ans. It was in the latter part of 1854 or the early part of 1855, in B. F. Cooke's office, now 17 Tremont street. Dr. Cummings used to go frequently to see Mr. Cooke; and in doing so he had to pass by the office I was in. One day I asked him why he called on Mr. Cooke so often.

His answer was, "I will tell you some day." In a short time he came into my office, and we both went into Mr. Cooke's office, and there he showed me what he had been doing. He showed me a set of teeth that Mr. Cooke was wearing, rubber base; also other samples that had been made. The set Mr. Cooke was wearing was a partial set—six or seven teeth—gum teeth—the same as used for gold-work; and some without gums. It fitted very well; the workmanship was fair; the color of the rubber poor.

Int. 33. Where is the Mr. Cooke you have spoken of, now?

Ans. Dead.

Int. 34. Was an explanation made to you at that time of the
137 mode in which the dental plates which you saw, composed of hard rubber, were manufactured?

Ans. There was.

Int. 35. Please state the substance of it.

Ans. First take an impression of the mouth, and from that impression make a wax-plate; then the teeth were to be placed on this wax-plate and fitted to the mouth; then placed in a plaster cast; the cast to be opened, the wax removed, rubber to be replaced, then vulcanized.

Int. 36. How was the impression of the mouth, spoken of in the first part of your answer, made?

(Objected to, the witness not having stated that such impression was made.)

Ans. Made from wax or plaster and then filled with plaster, and from this model was taken the wax-plate. It is the same way we make them now.

Int. 37. Please look upon the dental plate now shown to you and state when you first saw it.

Ans. I saw that, with others, in Mr. Cooke's office in the early part of the year 1855, or thereabouts; it was before I commenced to talk with Dr. Cummings about our partnership, which must have been in August, 1855.

(Complainants offer in evidence the dental plate spoken of by the witness, the same having been already marked Complainants' 12, N. A. P., in the suit in this court of the Dental Vulcanite Co. v. Isaac J. Wethérbee.

Defendant's counsel object to the assumption in the offer respecting said exhibit as not warranted by the mark thereon, which consists simply of the letters and figures, Comp. Ex. 12, N. A. P.

Complainants' counsel now states that this exhibit now forms a part of the files in the suit above referred to, and states also that he will make strict proof of that fact as soon as the examination of this witness is concluded. The dental plate thus offered in evidence is thereupon marked Complainants' Exhibit Flagg No. 1, J. G. S., Examiner.)

Int. 38. Who made Complainants' Exhibit Flagg No. 1?

Ans. Dr. Cummings.

Int. 39. At about the time you saw Complainants' Exhibit Flagg No. 1, did you see other dental plates of hard rubber in the possession of Dr. Cummings?

138 Ans. I did.

Int 40. Please describe those you so saw?

Ans. They were experiments; some had teeth attached and some were plates without teeth.

Int. 41. How did they compare in color and workmanship with the plate Exhibit Flagg No. 1?

Ans. They were all about the same.

Int. 42. Have you ever visited the Patent Office at Washington, and examined a set of teeth placed therein as a model, with Dr. Cummings's application in 1864?

Ans. I have; either the very last of 1864 or the early part of 1865.

Int. 43. Please describe the set so filed as a model and state whether you ever saw it before, and when and where you first saw it?

(Objected to, as the model itself being the best evidence so far as the question asked for a description of it.

The witness here asks if he can refer to Defendant's Exhibit Duplicate Cummings's model, and is informed that he can.)

Ans. It was an upper set, base of hard rubber, gum, single teeth attached, such as used in gold and silver work, electro-plated with a composition, then gilded over with gold, same as a part of this model duplicate Cummings's model. I first saw this set of teeth when I first went into partnership with Dr. Cummings; it was in his show case.

Int. 44. How did this set which you have last referred to compare with Complainant's Exhibit Flagg No. 1, and with Defendant's Exhibit Duplicate Cummings's Model?

Ans. That in the Patent Office I should say was a trifle darker, but could not judge well, as there was but a small space uncovered. It was all covered up but a small space.

Int. 45. Do you use gutta-percha in your practice as a dentist; and, if yea, state the purposes particularly for which you use it?

Ans. I do. We use it as a plate to arrange and place the teeth preparatory to making a hard-rubber plate.

Int. 46. Please state how you so use it, minutely and particularly.

Ans. After the model is made of the mouth, we place a gutta-percha plate on this model, dipping it into boiling water, and when it is in this soft state, fit it to the model with the hands, I might say fingers instead of hands; it is then fitted to the patient's mouth. Afterwards wax
139 is placed on this plate to represent the teeth, then an articulator is made; afterwards this wax is cut away and replaced by teeth; then the plate and teeth are placed in an iron mould imbedded in plaster one-half. After this plaster becomes hardened we fill the other half with plaster; after this becomes hardened we separate this mould; then we remove the wax and gutta-percha, replacing it with rubber; then this mould and rubber is heated in boiling water and pressed down in its proper position ready for vulcanizing.

(Witness desires to state that in answer to interrogatory 43, he should have said that he saw the set of teeth referred to before he went into partnership with Dr. Cummings instead of what he did.)

Int. 47. You have stated your present use of gutta-percha in dentistry; please state for what purposes you have ever used gutta-percha in dentistry other than as you have mentioned?

Ans. When we used gold and silver for temporary work, I used it to cover the gold or silver plate which was exposed while the patient was smiling or laughing. This took the place of gum teeth.

Int. 48. Please state when you so used gutta-percha?

Ans. Before we used rubber.

Int. 49. Please state what you found the capacity of gutta-percha to be, to resist the action of the fluids of the mouth?

Ans. With some patients it had to be removed as often as once a month or less, while with others it would remain from three to six months.

Int 50. How would the effect of the action of the fluids of the mouth show itself upon gutta percha thus spoiled?

Ans. By being ragged and rough, also being discolored.

Int. 51. Would the action of the fluids of the mouth produce any effect in respect to rendering the gutta-percha obnoxious to any other senses than the sight?

(Objected to as a squint at gutta-percha, tending to bring it into bad odor before the court.)

Ans. It would.

Int. 52. Please describe how the effect was produced described in your last answer and what the effect was.

Ans. It becomes ragged, rough, and soft, producing a very offensive odor after being used any length of time.

Int. 53. Please state whether you ever made a dental plate of unvulcanized gutta-percha; and, if yea, state the particulars thereof and what was the result, and when you made this experiment?

140 Ans. I did. In the winter of 1855 and 1856 I made a whole upper set and put it into the mouth; patient returned the next day with it all warped out of shape.

Int 54. Please state the reason why the gutta-percha plate was warped out of shape?

Ans. The heat of the mouth was too great for it.

Int. 55. Please look upon the translation annexed to Defendant's Exhibit 52 and state whether, in your opinion, as a dentist, the directions contained therein would have enabled a dentist of ordinary skill in 1851 to construct, strictly in accordance with said directions, a practically useful dental plate, and also whether those directions would now enable a dentist of ordinary skill to construct a practically useful dental plate?

Ans. I don't think any one could. I do think that one could put up a plate now, from these directions, but when finished it would be useless.

Reserving objections noted, defendant's counsel cross-examines as follows:

Cross-int. 56. When you first knew John A. Cummings was he a practicing dentist?

Ans. He was.

Cross-int. 57. Where?

Ans. 25 Tremont street; that was the number then.

Cross-int. 58. From that time until 1855, what did you know of him?

Ans. Used to meet him frequently; also called upon him often.

Cross-int. 59. How came you to form a partnership with him in 1855?

Ans. What first brought it about? By meeting him or seeing him so often going up stairs to see Mr. Cooke.

Cross int 60. When you formed your partnership, had you any written agreement with Dr. Cummings?

Ans. I had.

Cross-int. 61. Can you produce it?

Ans. I don't think I can; it is destroyed, I think. We have been burned out twice in that place.

Cross-int. 62. Can you remember the date of it?

Ans. November, 1855.

Cross-int. 63. Was there any reference in that agreement to the rubber plate for dental uses?

141 Ans. There was not.

Cross-int. 64. Was there any understanding between you that the rubber plates were to be used in your practice?

Ans. There was not.

Cross-int. 65. Did he propose using the rubber plates in your practice?

Ans. He did.

Cross-int. 66. Did he so use them?

Ans. He did not.

Cross-int. 67. Did you use them in your practice during this partnership?

Ans. I did not.

Cross-int. 68. Do you know of their use by any dentist during that time?

Ans. I don't remember of any.

Cross-int. 69. When did you introduce the rubber plate into your practice?

Ans. 1862.

Cross-int. 70. Not until then?

Ans. No, sir.

Cross-int. 71. Before 1862, do you know of any other dentist who made the rubber plate; and, if yea, who was it?

Ans. There were quite a number of dentists using it before I did, but I can't call to mind any particular one, for I did not introduce rubber until I was obliged to, having had repeated calls for it.

Cross-int. 72. Don't you know that it was in common use among dentists in and even before 1862?

Ans. I did.

Cross-int. 73. Did you know of its use before 1862, under the American Hard Rubber Company's license and directions as published?

Ans. I know that it was used a great deal before I took my license, which was in 1862.

Cross-int. 74. From whom did you take your license in 1862?

Ans. Hard Rubber Company.

Cross-int. 75. How long did you work under that license?

Ans. Until the Dental Vulcanite Company was formed in 1864.

Cross-int. 76. Did Dr. Cummings know that you had this American Hard Rubber Company's license, and worked under it?

Ans. I do not know.

142 Cross-int. 77. Did he have a license from that company to your knowledge?

Ans. Not to my knowledge.

Cross-int. 78. When did Dr. Cummings begin to make the vulcanite plates in his practice, as far as you know?

Ans. Not while he was in company with me; think he made rubber plates after he went into business for himself.

Cross-int. 79. You mean after you dis'olved?

Ans. I do.

Cross-int. 80. That was in 1860, wasn't it?

Ans. No; in 1861.

Cross-int. 81. When you formed your partnership, who was head of the concern, you or Dr. Cummings?

Ans. Dr. Cummings. The name was Cummings and Flagg.

Cross int. 82. Who was in the best pecuniary circumstances, you or Dr. Cummings, during this partnership?

Ans. The first part he was; the last part I was.

Cross-int. 83. Were you equal partners, each having half the profits, or how otherwise?

Ans. Equal.

Cross int. 84. What was your practice worth in 1855?

Ans. That is a question I can't answer, as we went in about the close of 1855.

Cross-int. 85. Then in 1856?

Ans. It might have been worth, say the whole of it, from fifteen hundred to two thousand dollars per year. I mean net profits.

Cross-int. 86. Had you a family?

Ans. Wife.

Cross-int. 87. What was the practice worth in 1857?

Ans. About the same as before.

Cross-int. 88. In 1858?

Ans. A little better; it might be two thousand or a little more; that is, the firm's, his and mine, too.

Cross-int. 89. In 1859?

Ans. I think it might be twenty-five hundred dollars.

Cross-int. 90. In 1860?

Ans. I was only in with him six months in 1860. I bought him out in July, 1860.

Cross-int 91. During this time, 1855 to 1860, when you kept his books, did he draw out all his share of the profits each year?

143 Ans. He did.

Cross-int. 92. What lead to his insolvency in 1860, extravagance or misfortune?

Ans. He was inclined to be extravagant.

Cross-int. 93. Did he spend more than his income while you kept his books?

Ans. He did; particularly the latter part of the time.

Cross-int. 94. Did you allow him to overdraw his account?

Ans. I did.

Cross-int 95. How much? Instance the extremes at different times.

Ans. It could not be very much; for we had not much to overdraw. It might be three or four hundred dollars at a time. I cannot say positively.

Cross-int. 96. When you speak of net profits in your business, as above, do you mean gross receipts less business expenses, or business and living expenses?

Ans. Business.

Cross-int. 97. When you dissolved, was he in your debt, and how much?

Ans. I can't say. I gave him so much. I assumed all the debts, and I keeping all the accounts of the ledger. I bought the good will of the business for about one thousand dollars.

Cross-int. 98. Do you mean that he went out with a thousand dollars in money, and his accounts with you squared?

Ans. I do; as far as Cummings and Flagg's accounts were concerned.

Cross-int. 99. How did you stand on any other score; did he owe you money?

Ans. Everything was squared up.

Cross-int. 100. Wasn't he a man of bad habits?

Ans. I have seen men with better habits.

Cross-int. 101. Question one hundred repeated.

Ans. The same.

Cross-int. 102. Question repeated.

Ans. Many a man has worse habits than he had.

Cross-int. 103. Are they worse, do you mean, in kind or in degree than his?

Ans. Both.

144 Cross-int. 104. Please inform the court what bad habits Dr. Cummings had. Did he drink?

Ans. He did.

Cross-int. 105. Sometimes to excess?

Ans. I think that a man that drinks any, drinks to excess.

Cross-int. 106. Did he drink more than some other men?

Ans. I don't think he drank as much as some men I know of. He liked a good time.

Cross-int. 107. How much did he drink before he felt he was having a good time?

Ans. That I am unable to say.

Cross-int. 108. Is it not true that his nervousness, irritability, and incapacity for professional work was aggravated by his bad habits?

Ans. I think it was; that and his scrofula trouble.

Cross-int. 109. When was the arrangement made, as you have testified, after you dis'olved partnership, for Dr. Cummings's resumption of practice?

Ans. 1861.

Cross-int. 110. How long, how many months was this after you dis-'olved?

Ans. About a year; it might be a trifle more or less.

Cross-int. 111. During the time you kept the books of the partnership had Dr. Cummings any source of income other than your business?

Ans. I don't think he had.

Cross-int. 112. More than he speculated a little outside, you said, did you not?

Ans. Yes.

Cross-int. 113. What did he speculate in?

Ans. He would go up to the auction-room occasionally, on a Saturday, and buy some small things that he might see.

Cross-int. 114. State what sort of investments he made at the auction-rooms?

Ans. Such as second-hand chairs, carpets, in fact most anything that was sold at those auction-rooms.

Cross-int. 115. Were not these all cash transactions?

Ans. They were not.

Cross-int. 116. Then he had credit, did he?

Ans. He did; they were left there and sold next week.

145 Cross int. 117. And he and the auctioneer settled the difference, did they?

Ans. I presume so.

Cross-int. 118. During this interval between your dissolution and Dr. Cummings's resumption of business, what did he do, so far as you know?

Ans. After our dissolution for a time he remained in my office (in one of the rooms) and sold toothwash, powder, and nerve-anodyne.

Cross-int. 119. You have said that from 1860, until the time when he obtained his patent, he was growing worse and worse pecuniarily; during this same time were his habits growing worse and worse also?

Ans. They were not improving by any means.

Cross-int. 120. When the patent was procured, the assignment was made to you and Dr. Osgood as agreed, was it not?

Ans. It was.

Cross-int. 121. And you and Dr. Osgood held that interest until it was sold to or merged in the Dental Vulcanite Company of Massachusetts?

Ans. We did.

Cross-int. 122. What was your consideration for that interest?

Ans. A few shares over six hundred.

Cross-int. 123. Was that interest merged in this corporation complainant, Goodyear Dental Vulcanite Company?

Ans. It was.

Cross-int. 124. How much of that corporation-stock do you own?

Ans. Not a share.

Cross-int. 125. How much was your interest in it?

Ans. Somewhere about seven hundred shares, more or less.

Cross-int. 126. One hundred dollars a share par value, was it?

Ans. Yes, sir.

Cross-int. 127. When did you sell out?

Ans. I must have sold out as many as six or eight times entirely.

Cross-int. 128. Do you mean that you sold out and bought in, and then sold out again, or that you sold out in lots?

Ans. Sold out entirely and then bought in again.

Cross-int. 129. When was your last deal in this stock?

Ans. I should say from three to five months ago; it must be more than three.

146 Cross-int. 130. How many shares did you sell then?

Ans. Forty-one, I think.

Cross-int. 131. When did you buy them?

Ans. I could not say; I bought them in small lots; two or three lots.

Cross-int. 132. Within a year?

Ans. Yes, sir.

Cross-int. 133. Did you sell out to the company; this corporation?

Ans. No, sir; I sold to a broker.

Cross-int. 134. Have you got any written or verbal contract to purchase or sell any of this stock?

Ans. Have not.

Cross-int. 135. When did you first see Dr. Cummings make and vulcanize a rubber plate?

Ans. I never saw him.

Cross-int. 136. What do you mean, then, when you say in answer to interrogatory thirty-two, "We both went into Mr. Cooke's and he showed me what he had been doing; he showed me a set of teeth that Mr. Cook was wearing, rubber base; also other samples that had been made?" Who did you understand made that base and those samples?

Ans. I understand that Mr. Bevins made them, he being employed by Dr. Cummings. When I say Mr. Bevins, I mean that he vulcanized them for Dr. Cummings.

Cross-int. 137. Who was Mr. Bevins, and what was his first name or initials?

Ans. A man whom Dr. Cummings employed, he understanding how to work rubber; his initials, F. A.—Frederick A.

Cross int. 138. Did you see Bevins make a rubber plate; and, if yea, when first?

Ans. Soon after I went into partnership with Dr. Cummings, Mr. Bevins came into the laboratory and prepared a set for vulcanizing. I did not see him vulcanize it, as we had no vulcanizer there.

Cross-int. 139. Where was Bevins from?

Ans. Connecticut, I think.

Cross-int. 140. Do you know what experience he had had in vulcanizing?

Ans. I do not.

Cross-int. 141. Then it was after November, 1855, or at least not

147 earlier than November, 1855, that you first saw a rubber plate made or prepared to be vulcanized?

Ans. I did not see it vulcanized then; I only saw it being prepared for vulcanizing.

Cross-int. 142. And then for the first time?

Ans. Yes, sir.

Cross-int. 143. Please state exactly what Bevins did in preparing that plate?

Ans. Between he and Dr. Cummings they arranged some teeth on a plate; afterward Mr. Bevins put it into plaster, similar as we do it now, with the exception of not having a flask, which we all of us use now.

Cross-int. 144. Was this plate for a pattern, or merely an experimental piece?

Ans. Experimental.

Cross-int. 145. How did they arrange the teeth on that plate; and how was that plate on which the teeth were arranged made?

Ans. I did not see them arrange it; I was attending to my own business. I only saw it after it was arranged.

Cross-int. 146. Did you see Bevins put that plate into plaster?

Ans. I did.

Cross-int. 147. Now, first, please state how the teeth were arranged on that plate, and how the plate was arranged for being put into plaster?

Ans. When I saw it it was a wax plate, teeth arranged as usual; then he set it into plaster about half way, filled it again, opened it; after hardening, took the wax out; then it was ready to put in the soft rubber.

Cross-int. 148. Did you see him pack the mould?

Ans. I did not. In using the expression ready for vulcanizing, I mean the wax entirely removed; we speak in our office of the mould in this condition, as ready for vulcanizing.

Cross-int. 149. Then, in fact, what you saw at this time was the mould ready to be filled, but not with any rubber in it?

Ans. It was.

Cross-int. 150. When did you first see a rubber plate moulded and vulcanized?

Ans. I don't think I saw one until 1862.

Cross-int. 151. Who did it—the first one you saw?

148 Ans. I can't say; but I think it was some person that came around when we bought the license.

Cross-int. 152. From the Hard Rubber Co.?

Ans. Yes, sir.

Cross-int. 153. Was Bevins a dentist?

Ans. He was not.

Cross-int. 154. When you first began to make these rubber-plates, Dr., (in 1862), did you pack and vulcanize them yourself, or did you merely arrange the teeth and prepare the moulds, and then have the packing and vulcanizing done by others outside?

Ans. It was all done in my office.

Cross-int. 155. Did you do it yourself? I mean with your own hands?

Ans. I only arranged the teeth; my men did the rest of it.

Cross-int. 156. That is, your men made the mould, packed and vulcanized it?

Ans. Yes, sir.

Cross-int. 157. Were they dentists—these men?

Ans. Mechanical dentists.

Cross-int. 158. Mechanical dentists means not operative dentists, I believe.

Ans. Yes, sir.

Cross-int. 159. Was the skill required for vulcanizing the plate after the mould was packed anything more than a person acquainted with vulcanizing other things of rubber would possess?

Ans. I should say not.

Cross-int. 160. In 1855, was Bevins in Dr. Cummings's employ from the time of the partnership you formed with him, and how long thereafter?

Ans. I can't say that he was in his employ after I went into partnership with him. He never was in the firm's employ. I never saw Bevins in Dr. Cummings's office before I went into partnership with him.

Cross-int. 161. This set that you say Cooke was wearing was a partial set gum teeth, the same as used for gold work, and some without gums; when did you see that last?

Ans. I don't recollect. I saw it in his mouth and out of it a number of times.

Cross-int. 162. Were there pins in those teeth that you could see?

149 Ans. Not that I recollect.

Cross-int. 163. Could you tell how that piece had been made?

Ans. I did not know anything about rubber-work until I saw that. I could not tell when I saw it how it was made.

Cross-int. 164. How many ways do you know now in which you could make a plate of hard rubber practically useful for a patient?

Ans. I don't know of only one way.

Cross-int. 165. What way is that?

Ans. The same as we do now.

Cross-int. 166. Describe it.

Ans. Take an impression, and from the impression a model; from the model a plate; then arrange the teeth upon this wax or gutta-percha plate; then placed in this flask imbedded in plaster one-half; then filled the other half, the flask opened and the wax and gutta-percha removed, then filled with soft rubber, heated in boiling water, flask screwed down ready for vulcanizing.

Cross-int. 167. What was the color of this Cooke piece?

Ans. A dark brown.

Cross-int. 168. How did it compare with this Exhibit Flagg No. 1, in color?

Ans. I think it was a trifle darker than this. This is bleached, grown lighter, this Exhibit Flagg No. 1.

Cross-int. 169. Do you know whether this Exhibit Flagg No. 1 was made in the way you have described in your answer to cross-int. 166?

Ans. I do not; but I can't see how it could have been made otherwise.

Cross-int. 170. Why not?

Ans. I do not know how to make a rubber plate any way other than that I have described.

Cross-int. 171. You say, in answer 34, that "an explanation was made to you at that time of the mode in which the dental plates which you saw composed of hard rubber were manufactured." Who made this explanation to you?

Ans. Dr. Cummings and Mr. Bevins.

Cross int. 172. In answer 35 you state the substance of that mode as then explained to you. Do you now swear positively that Dr. Cum

mings and Mr. Bevins made that explanation at the time you saw this piece in Mr. Cooke's office, 17 Tremont street?

Ans. I do; between them both.

150 Cross-int. 173. You swear the described as the mode in which the dental plates which you saw composed of hard rubber were manufactured was first, take an impression of the mouth, and from that impression make a wax plate; then the teeth were to be placed on this wax plate and fitted to the mouth; then placed in a plaster cast, this cast to be opened, the wax removed, rubber to be replaced, then vulcanized; the impression of the mouth being made from wax or plaster and then filled with plaster, and from this model was taken the wax plate; and you add, it is the same way we make them now. Do you adhere to those statements?

Ans. That is the substance of what they repeated to me, I might say, unless, perhaps, with the exception of the taking the impression. There was no use of that. I knew all about it.

Cross-int. 174. You say you saw some experimental plates of hard rubber in the possession of Dr. Cummings at that time; some had teeth and some were plates without teeth. Were teeth to be attached to the plates that were without them when you saw them; and if yea, how?

Ans. I suppose they were not; only experiments.

Cross-int. 175. The Patent-Office model which you have referred to you say you saw before you went into partnership with Dr. Cummings. Am I right in understanding you to have said that when you saw it first it was entirely covered with the plating, so that the rubber was entirely concealed?

Ans. The rubber was entirely concealed when I first saw it.

Cross-int. 176. How could you identify it nine or ten years after, when you saw it in the Patent-Office; and where was it in the meanwhile, if you know?

Ans. In Cummings and Flagg's show-case up to the time it was sent to the Patent-Office; and before it did go to Washington this gilding had started up a little. I would identify it from the shape of the mouth the same as I would a man's face.

Cross-int. 177. Do you mean that it was in Cummings and Flagg's show-case from 1858 to 1864?

Ans. Yes I do; there and thereabout.

Cross-int. 178. Where did the show-case stand during this time?

Ans. In the back room most of the time, where it is now.

Cross-int. 179. What was this Patent-Office model designed to represent in that show-case?

Ans. Cummings had in that show-case as many as half a dozen of those rubber sets as a show.

151 Cross int. 180. Were they all covered with gilt metal, as this Patent-Office model was?

Ans. They were not.

Cross-int. 181. Was this covering put on this Patent-Office model to conceal the material, or to hide defects, or to exemplify the application of gilded metal to the rubber, or for any other purpose; if yea, what purpose?

Ans. I think it was to please Dr. Cummings's fancy, as it was of no earthly use.

Cross int. 182. Why was it selected as the Patent-Office model instead of one of the plates that showed the rubber, that was in that show-case?

Ans. I don't know, unless because it was a whole upper set.

Cross-int. 183. During this interval were those rubber plates on ex-

hibition, or could they be seen by your visitors and patients in that show-case?

Ans. They could hardly be seen, for they were in a dark ante-room.

Cross-int. 184. Was there any reason except the darkness of the room that prevented their being seen by visitors or patients?

Ans. No, sir.

Cross-int. 185. During this period did you explain to anybody how these rubber plates in the show-case had been made?

Ans. Not to my recollection.

Cross-int. 186. Did you ever see that Patent-Office model-piece before it was covered with the metallic coating?

Ans. Never.

Cross-int. 187. Did you know, and, if yea, how, that the metallic coating covered a rubber plate before you saw it in the Patent-Office?

Ans. I did; Dr. Cummings showed it to me as a rubber plate. I also could see rubber between the joints of the teeth, and before it left for Washington there was a little piece of the gilding started up.

Cross-int. 188. Did you ever make a plate of vulcanized gutta-percha?

Ans. I never did.

Cross-int. 189. Did you ever make a plate of gutta-percha and have it vulcanized?

Ans. Never.

Cross-int. 190. Did you ever make a plate of rubber that was not vulcanized before it was used?

152 Ans. Never.

Cross-int. 191. Did you ever make a plate of rubber by first moulding the rubber to fit the shape of the mouth and forming the gums, and while soft and pliable, embedding the teeth in the gums, and as an additional security fastening the teeth to the gums by small pins, and then baking the teeth, gums, and plate thus connected?

Ans. Never.

Cross-int. 192. Did you ever know of a rubber plate being made that way?

Ans. Never.

Cross-int. 193. Think it could be made that way?

Ans. I think it could; but it would be a very imperfect job, and not fit to be worn.

Cross-int. 194. This gutta-percha that you use for temporary plates, was it pure and simple gutta-percha, or was it compounded with something else; and, if yea, with what?

Ans. I have used both. What it is compounded with I am unable to state.

Cross-int. 195. Don't the compounded gutta-percha stand the heat of the mouth better than the simple gutta percha?

Ans. By my experience I should say it would.

Cross-int. 196. In the translation annexed to Defendant's Exhibit 52, what is lacking, in your opinion as a dentist, to have enabled a dentist of ordinary skill, in 1851, to construct in accordance with said directions a practically useful dental plate?

Ans. In 1851 I don't think but few, if any, of the dentists had seen the English way of making artificial teeth, and without pivot teeth were used, we have not any teeth in this country that is adapted to this kind of work, as is described in the translation of Exhibit 52. After this plate was made, according to the directions therein described, I shouldn't consider that it would remain in the patient's mouth unchanged for a day.

Cross-int. 197. That relates to the plate after it was made. My question was intended to inquire what was lacking in that translation in the way of sufficient direction for a skilled dentist to make the plate.

(Counsel for complainants objects to the criticisms, and says that the question related to a practically useful dental plate, and that the witness answered the question correctly, for a dental plate that would not last a day is not practically useful.

153 Defendant's counsel states that he now proceeds to supplement his criticised criticisms by concluding what he had commenced to ask the witness, to wit:)

What is lacking in the directions, so far as making the plate is concerned, aside from the question of degree of durability or utility after the plate is made?

Ans. I think one might make a plate from this description, but if he had not those English teeth, or had never seen one, he could not complete the operation.

Cross-int. 198. Why not?

Ans. There is but one kind of teeth adapted to this mode of putting them up without pivot teeth now used.

Cross-int. 199. Well, how is it that the directions would now enable a dentist of ordinary skill to put up a plate better than in 1851?

Ans. Dentists are more accustomed to using gutta-percha.

Cross-int. 200. What do you understand in those directions to be indicated by the temperature of one hundred degrees; Fahrenheit or centigrade?

Ans. Centigrade.

Cross-int. 201. From 1860 to 1870 did you see much of Dr. Cummings?

Ans. From 1860 to 1862, quite often; from 1862 until his patent was procured, very little; from 1864 until 1869, very often, with the exception of the time he was in Europe; the last year of his life, very little.

Cross-int. 202. Up to 1862, when you adopted the rubber work, had the color of the compound been made satisfactory?

Ans. It had not.

Cross-int. 203. When was that attained?

Ans. It never has been made satisfactory.

Direct examination resumed:

Int. 204. In your answer in cross-interrogatory 199, you say "Dentists are more accustomed to using gutta-percha;" for what purpose are they more accustomed to using gutta-percha?

Ans. For the purpose of arranging the teeth; also to get the size and thickness of the plate, as the rubber plate will be a duplicate of the gutta-percha. It is merely a form for the rubber plate.

Int. 205. Is any other substance used by dentists for the same purpose?

Ans. Yes, there is; wax, or gutta-percha and wax.

154 Cross-examination resumed:

Cross-int. 206. Isn't gutta-percha compounded with oxide of zinc mainly used by dentists for the purpose of forming the plate of which the rubber plate will be a duplicate, as mentioned by you in your redirect examination?

Ans. I don't know how it is compounded.

G. H. P. FLAGG.

Attest:

JOHN G. STETSON,
Examiner.

Deposition of Albert G. Wilbur.

BOSTON, *Dec.* 3, 1873.

Direct examination by BENJAMIN F. LEE, Esq., of counsel for complainants:

Int. 1. Please state your name, age, residence, and occupation.

Ans. Albert G. Wilbur; 53; 554 Tremont street; druggist.

Int. 2. Did you ever know Dr. John A. Cummings of Boston? And, if so, please state how long and how intimately.

Ans. I knew him from 1848 until the time of his death. I was quite intimately acquainted with him from the first, having had business transactions with him.

Int. 3. How frequently were you in the habit of seeing him?

Ans. Almost every day, with the exceptions of the times he was in the country, out of town.

Int. 4. Do you remember that Dr. Cummings was in partnership at one time with Dr. Geo. H. P. Flagg? And, if yea, please state the period during which that partnership continued.

Ans. I do; he was in partnership from 1855 to 1860.

Int. 5. Did Dr. Cummings, after the dissolution of the partnership with Dr. Flagg, resume the practice of dentistry? And, if yea, please state the date at which he so resumed.

Ans. He did; he resumed in the early part of 1862.

Int. 6. About how long did he continue in business after such resumption?

Ans. About six months.

Int. 7. State whether or not your acquaintance with Dr. Cummings, from 1848 to 1870, were such as to give you knowledge of his circumstances and pecuniary condition.

Ans. It was.

155 Int. 8. Please state fully your knowledge on the subject, particularly as to his pecuniary condition after 1856.

Ans. About my first transaction with him was a trade or bargain; and I had an open account with him until he obtained his patent; at that time he settled in full. After 1856, he was poor at that time, he was trying to obtain money at that time to carry his invention forward and obtain his patent.

Int. 9. Did you ever furnish him with dental articles; and, if yea, at what time did you commence to do so?

Ans. I did; from 1849 or thereabout.

Int. 10. How long did you continue to furnish him with dental articles from time to time?

Ans. Up to 1862.

Int. 11. How did he pay you for the articles you so furnished him?

Ans. I took an equity in a house, that is one item; whatever dentistry in my family; the bills amounted to considerable; pew in church, fancy vase, harness, and other like articles; fifteen dollars is all I can—could ever find credited in the matter of money, in the whole transaction.

Int. 12. State generally the aggregate amount of all these transactions.

Ans. I think about four thousand dollars; not very far from that either way, as near as I can recollect.

Int. 13. Did the articles and cash, mentioned in your answer to interrogatory 11, serve to clear off his whole indebtedness to you?

Ans. It did not.

Int. 14. How much did he owe you in 1859?

Ans. I should think about five hundred dollars without looking.

Int. 16. Was he able to pay you at that time?

(Objected to as incompetent.)

Ans. He was not.

Int. 16. When Dr. Cummings resumed the practice of dentistry in 1862, did he succeed in establishing a practice?

Ans. He did not.

Int. 17. After Dr. Cummings gave up his attempt to practice dentistry, in 1862, what did he next do?

(Objected to as assuming what the witness hasn't stated.)

Ans. He went to his farm in Dunstable.

Int. 18. How long did he remain at the farm?

156 Ans. I think about two years, off and on.

Int. 19. Where did he go and what did he do next?

Ans. He came to live here in Boston, to live with his wife; and he attempted to start dentistry again; that is, he bought a chair, etc., corner of Asylum and Washington streets.

Int. 20. How was he supported after he came to Boston in 1864?

(Objected to as incompetent, and as calling for an incompetent answer.)

Ans. By whatever credit he could get, and his wife's earnings, I should say. She kept a boarding house.

Int. 21. What was the state of Dr. Cummings's health after 1856?

Ans. I should say that it was not good. I know he was in feeble health.

Int. 22. Did he ever recover his health?

Ans. Never.

Int. 23. Did you ever know of a certain invention of Dr. Cummings's in hard-rubber dental plates?

Ans. I did.

Int. 24. Please state when, from whom, and under what circumstances you first obtained knowledge of such invention.

Ans. About 1852 the doctor came into my place. He took out of his pocket a specimen of rubber plate; holding it in his hand, he remarked, "They are using rubber for one hundred and one things; I am going to have it so they can use it in dentistry to set teeth upon it."

Int. 25. State whether he subsequently spoke to you on the same subject.

Ans. I heard of it continually from that time until the time he obtained his patent.

Int. 26. From whom did you hear it?

Ans. Dr. Cummings.

Int. 27. What did he say to you on the subject? Give the general purport of his remarks.

(Objected to as calling for the general purport instead of the remarks themselves.

Counsel for complainants requests the witness to give the remarks themselves as nearly as possible.)

Ans. He being embarrassed, would refer to the invention from time to time as being the same from which he should obtain funds to pay his indebtedness. I can only say that it was a complete hobby, and that he was boring his friends all the time with this invention.

157 Int. 28. Did he state how he expected the invention to extricate him from pecuniary embarrassment?

(Objected to as leading.)

Ans. By receiving money for it.

Int. 29. Receiving money for what?

(Objection repeated.)

Ans. The invention, or patent I should say.

Int. 30. When and how often did he speak to you about his intention to patent this invention?

(Objected to as a leading question, and that without any foundation of any statement made by the witness.)

Ans. When he first showed it to me he spoke of it, and that was continued up to the time it was obtained.

Int. 31. Did he ever express to you his opinion as to the value and importance of this invention; and, if yea, how often, during what period, and what did he say?

Ans. He did. He claimed that it would supersede all other material, frequently. During the period he was expecting to obtain his patent, he claimed that it was worth millions; that there was a great deal of money in it.

Int. 32. Please state what you mean by the word frequently in your last answer.

Ans. Well, to say every six months, perhaps, or whenever an account might be made up, he would refer more particularly to the value of this invention, and its being the means by which he should settle up my account.

Int. 33. Please state as definitely as you can the period of time you refer to in your 31st answer, when you used the words, "During the period he was expecting to obtain his patent."

Ans. From the time he applied or filed his caveat until he obtained his patent.

Cross-examination by HENRY BALDWIN, Jr., counsel for defendants, reserving objections noted:

Cross-int. 34. What memorandum have you had in your hand and referred to in your examination-in-chief?

Ans. It's a matter of dates which I took from my books. For instance, in referring to my book it fixed my first charge, that being the first of my knowing the doctor, or about that date; then the end of the charges, 1870, fixes the time when he died; then, in the intervening time I would find charges of the date of the copartnership of
158 Cummings and Flagg; then, again, when he commenced business, I find new charges of dental articles.

Cross-int. 35. Have you got those books here which you refer to in your last answer?

Ans. I have.

Cross-int. 36. Will you turn to Dr. Cummings's first account and allow me to see it?

Ans. I will.

(Witness here produces a journal which he hands defendant's counsel for examination.)

Cross-int. 37. Now on one of these memoranda which you had in your hand I find written "May 14th, 1852, caveat." Is that from your books?

Ans. The date 1852 is there. I referred to the Wetherbee record to see what time the caveat was applied for, knowing at the time the doctor showed it to me that he had filed a caveat at the time the black-rubber plate was shown me.

Cross-int. 38. Did you refer to the date of that caveat in the Wether-

bee record for the date when this black-rubber plate was shown you, or did you refer to your books for that date?

Ans. I referred to my book, and I could not get at it exactly; then, by referring to this, I found that I was correct in my supposition of the time.

Cross-int. 39. Then you could not have fixed the time from your recollection, refreshed only by reference to your books, without reference to the Wetherbee record?

Ans. I should have sworn to it at the same time. I felt so certain of it as that.

Cross-int. 40. What is there on your books that refers to, or in your mind is connected with, the caveat?

(Objected to as assuming what the witness has not stated.)

Ans. Nothing more than dates of other transactions, and my recollection about the time he showed me the plate spoken of.

Cross-int. 41. I find on this memorandum, "Nov., '55, with Flagg to July, 1860." Did you get that from your books?

Ans. I did.

Cross-int. 42. Then during this period, Nov., '55, to July, '60, was your account with Cummings & Flagg, or did you have a separate account with Cummings?

Ans. I had both separate accounts.

159 Cross int. 43. Now, on the memorandum is "resumed in 1862 to July, 1862." How do you fix that?

Ans. That is another account on my books, opened with Dr. Cummins individually, with charges running from and up to that time.

Cross-int. 44. Next on the memorandum is "to from about July." Is that fixed by your books?

Ans. It is, by dates from that, and from my knowledge of his going about that time.

Cross-int. 45. And last on the memorandum is "return April 1, 1864." Is that fixed by your books?

Ans. About that time I find charges made on my books.

Cross-int. 46. Did Flagg & Cummings dissolve as early as July, 1860?

Ans. I have no other means of knowing except by charges. I cannot say that they did exactly; I know it was about that time.

Cross-int. 47. What is the date of the last charge to the partnership in your account with it?

Ans. July 13, 1860. August 3, 1860, I closed the account. It was charged to Dr. Cummings as cash, and settled at that date.

Cross-int. 48. From 1848 to 1852 what was Dr. Cummings doing, and when?

Ans. I find by referring to my books that in 1849 he was practising dentistry; in 1850, 1851, and 1852, the same.

Cross-int. 49. From 1852 until he went with Flagg, was he practising all the time, and alone?

Ans. I find the charges during all that time for the dental articles such as he was using. He was.

Cross-int. 50. Did you make up his account every six months?

Ans. I think I used to figure it up every six months. I find that I figured it up oftener than that; there was no stated period. He would come in and enquire how much he had had, and would have it endorsed on my paper, and stop the interest. I shall have to explain further: after a few or a number of years his account was quite large. I then made a trade with him, or took an equity in a house; the agreement was he should take the excess; that I was to pay him in like articles

(dental articles), and, speaking of endorsing on the paper, I mean on that indebtedness or agreement.

Cross-int. 51. When was this arrangement or agreement made by your taking an equity in a house?

160 Ans. I sha'n't be able to state that unless I refer to some paper in my possession.

Cross-int. 52. Can you state whether it was before, or during, or after the partnership with Flagg?

Ans. It was some time before the partnership.

Cross-int. 53. Whose house was it that you took an equity in under this arrangement?

Ans. It stood in the name of Dr. Cummings's mother.

Cross-int. 54. How and when did you close out this equity in that house? Did Dr. Cummings trade out the balance, or did you pay him the balance, or how was it?

Ans. I put up a quantity of material at once, and he shipped it to California; that account was never settled, but run right along until he got his patent.

Cross-int. 55. Didn't the equity in the house settle the account to the time you took that?

Ans. It did; and there was an excess to Dr. Cummings's credit, as I said before.

Cross-int. 56. Then this material for California was on account of the balance due Dr. Cummings?

Ans. Yes.

Cross-int. 57. What was that house worth in which you took an equity?

Ans. It was taxed for about six thousand dollars; there was a mortgage on it for five thousand to Mr. Minot. I bought it for seventy-five hundred dollars in about the year 1853.

Cross-int. 58. What was this material he sent to California?

Ans. Tooth-wash, tooth-powder, and toothache drops.

Cross-int. 59. After 1856 how much money did Dr. Cummings require to carry his invention forward and obtain his patent?

Ans. He applied to me for from two to three hundred dollars, not to exceed three hundred, for which he promised to give me one-quarter of this patent when obtained.

Cross-int 60. Did you let him have the money?

Ans. I did not.

Cross-int. 61. When was this application made to you?

Ans. It was after he went to the farm, certain, in 1862.

Cross-int. 62. Was that the effort you referred to when you say he was trying to obtain money at that time to carry his invention forward and obtain his patent?

161 Ans. I refer to it generally; this was one time especially when I know of his applying.

Cross-int. 63. State any other effort that you know of, and when he made it.

Ans. I don't understand the question exactly, whether it is an effort to get the patent. I know of his applying for money for that special purpose to others.

Cross-int. 64. You say in answer to interrogatory eight, "After 1856, he was poor at that time, he was trying to obtain money at that time to carry his invention forward and obtain his patent." My question now is, what other effort than the application to you for money did Dr.

Cummings make to obtain money at that time to carry his invention forward and get his patent?

Ans. He applied to other parties for money.

Cross-int. 65. How do you know the purpose for which he made these applications for money?

Ans. The parties to whom he applied told me so.

Cross-int. 66. Then what they told you is all you know of those other applications?

Ans. It is.

Cross-int. 67. Did the equity which you took in this house cover the account of Dr. Cummings and yourself in 1862?

Ans. It did not.

Cross-int. 68. When Dr. Cummings settled up with you after he got his patent, how much was the amount due you?

Ans. I think five hundred dollars; something about that.

Cross-int. 69. Was that the same five hundred miles or thereabouts that he owed you in 1859?

Ans. Whatever he owed me in 1859 he owed me in 1864.

Cross-int. 70. This farm in Dunstable that he went to in 1862, who owned that, if Dr. Cummings did not?

(Objected to as incompetent.)

Ans. His mother died about that time and left it to him. (This is something I don't really know about.)

(The latter part of the answer was added after the objection was interlined.)

Cross-int. 71. You say that about 1852 Dr. Cummings came into your place and took out of his pocket a specimen of rubber plate. What time in 1852 was this? Fix it as nearly as you can.

Ans. I don't know about that; I referred to this memorandum
162 (the one heretofore spoken of). I felt quite sure that it was in 1856, and on referring to the Wetherbee record I found it was in 1852.

Cross-int. 72. Aside from the Wetherbee record, can you state whether it was before or after May 14, 1852?

Ans. I could not.

Cross-int. 73. What was this specimen of rubber plate which you say Dr. Cummings took out of his pocket?

Ans. I saw something here that would illustrate it. It was a simple black-rubber plate, with indentations on it for the teeth to be put in.

Cross-int. 74. There were no teeth in it, then?

Ans. Not any.

Cross-int. 75. Had it been vulcanized?

Ans. I don't know about that; I presume it had; it was in shape and form; it was rather a tough specimen.

Cross-int. 76. Had you any business connection with Dr. Cummings after 1860 other than to furnish him with dental articles?

Ans. I sold him other things—family medicines.

Cross-int. 77. You had no interest in his business affairs?

Ans. Not any.

Cross-int. 78. Nor in his patent or invention?

Ans. Not any.

Cross-int. 79. Do you own any stock in the Goodyear Dental Vulcanite Company, this corporation complainant?

Ans. I should have to get some information to know. I can get it right here. The position is rather queer.

(dental articles), and, speaking of endorsing on the paper, I mean on that indebtedness or agreement.

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Cross-int. 54. How and when did you close out this equity in that house? Did Dr. Cummings trade out the balance, or did you pay him the balance, or how was it?

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161 Ans. I refer to it generally; this was one time especially when I know of his applying.

Cross-int. 63. State any other effort that you know of, and when he made it.

Ans. I don't understand the question exactly, whether it is an effort to get the patent. I know of his applying for money for that special purpose to others.

Cross-int. 64. You say in answer to interrogatory eight, "After 1856, he was poor at that time, he was trying to obtain money at that time to carry his invention forward and obtain his patent." My question now is, what other effort than the application to you for money did Dr.

Cummings make to obtain money at that time to carry his invention forward and get his patent?

Ans. He applied to other parties for money.

Cross-int. 65. How do you know the purpose for which he made these applications for money?

Ans. The parties to whom he applied told me so.

Cross-int. 66. Then what they told you is all you know of those other applications?

Ans. It is.

Cross-int. 67. Did the equity which you took in this house cover the account of Dr. Cummings and yourself in 1862?

Ans. It did not.

Cross int. 68. When Dr. Cummings settled up with you after he got his patent, how much was the amount due you?

Ans. I think five hundred dollars; something about that.

Cross-int. 69. Was that the same five hundred miles or thereabouts that he owed you in 1859?

Ans. Whatever he owed me in 1859 he owed me in 1864.

Cross-int. 70. This farm in Dunstable that he went to in 1862, who owned that, if Dr. Cummings did not?

(Objected to as incompetent.)

Ans. His mother died about that time and left it to him. (This is something I don't really know about.)

(The latter part of the answer was added after the objection was interlined.)

Cross-int. 71. You say that about 1852 Dr. Cummings came into your place and took out of his pocket a specimen of rubber plate. What time in 1852 was this? Fix it as nearly as you can.

Ans. I don't know about that; I referred to this memorandum
162 (the one heretofore spoken of). I felt quite sure that it was in 1856, and on referring to the Wetherbee record I found it was in 1852.

Cross-int. 72. Aside from the Wetherbee record, can you state whether it was before or after May 14, 1852?

Ans. I could not.

Cross-int. 73. What was this specimen of rubber plate which you say Dr. Cummings took out of his pocket?

Ans. I saw something here that would illustrate it. It was a simple black-rubber plate, with indentations on it for the teeth to be put in.

Cross-int. 74. There were no teeth in it, then?

Ans. Not any.

Cross-int. 75. Had it been vulcanized?

Ans. I don't know about that; I presume it had; it was in shape and form; it was rather a tough specimen.

Cross-int. 76. Had you any business connection with Dr. Cummings after 1860 other than to furnish him with dental articles?

Ans. I sold him other things—family medicines.

Cross-int. 77. You had no interest in his business affairs?

Ans. Not any.

Cross-int. 78. Nor in his patent or invention?

Ans. Not any.

Cross-int. 79. Do you own any stock in the Goodyear Dental Vulcanite Company, this corporation complainant?

Ans. I should have to get some information to know. I can get it right here. The position is rather queer.

Cross-int. 80. What makes any doubt you have about it?

Ans. I held stock in my name which was transferred to me as security, and I have left them with Mr. Bacon for transfer. I do not know whether they have been transferred or not.

Cross-int. 81. How much was it?

Ans. Nine hundred and fifty-two shares; it belongs to the estate of Dr. John A. Cummings. I can't get at the number of shares exactly, as there are a number coming from other parties.

Cross-int. 82. Nine hundred and fifty-two shares would be $95,200 par value, would it not?

Ans. It would.

Cross-int. 83. Does Dr. Cummings's estate owe you money?

Ans. I am trustee of the estate of Dr. John A. Cummings. His property was all given to me in trust for the benefit of his heirs.

163 Cross-int. 84. Does that estate owe you money?

Ans. It does.

Cross-int. 85. Is that stock to secure the money the estate owes you, or is it security to you as trustee, or both?

Ans. Neither. The stock was transferred to me for an old indebtedness. What the estate now owes me is overdrawn or overpaid on the account as it stands on my books.

Cross-int. 86. Was that indebtedness from Dr. Cummings to you?

Ans. It was.

Cross-int. 87. Did it accrue after 1864?

(Objected to as incompetent and irrevelant.)

Ans. It did.

Cross-int. 88. What was the amount of it?

(Same objection.)

(Counsel for complainants states to the witness that it is optional to him whether he answers the question or not.)

Ans. It was under an agreement. The doctor found himself very much in debt, and I advanced him five thousand dollars, and agreed to furnish other amounts that might be needed to keep his affairs in good shape, he being very low at the time. There was an assignment after the agreement; this was in 1869.

Cross-int. 89. What was the amount of the indebtedness for which this stock is your security?

(Objected to as incompetent, irrelevant, and assuming what is not proved.)

Ans. It was; it isn't security now. I have already stated I paid five thousand, and agreed to pay any other that might be needed. The doctor died, and his executor settled those matters.

Cross-int. 90. How came you to be made trustee if there was an executor of the estate?

(Same objection.)

Ans. I was appointed under the will. The executor settled the estate, and then transferred it to me as trustee.

Cross-int. 91. If the executor settled the estate, how came he to leave this individual indebtedness to you unsettled?

Ans. He did not; he paid me.

Direct resumed:

Cross-int. 92. When you saw the black-rubber dental plate which was in Dr. Cummings's hands in 1852, was it hard like Complainants' Exhibit Flagg No. 1?

164 (Objected to, first, because it designates the black-rubber plate

spoken of by the witness as a dental plate; and second, because as to the hardness of the black-rubber plate it is leading.)

Ans. It was.

A. G. WILBUR.

Attest:

JOHN B. STETSON,
Examiner.

Deposition of David Thayer.

BOSTON, *December* 3, 1873.

Direct examination by BENJAMIN F. LEE, Esq., of counsel for complainants:

Int. 1. Please state your name, age, residence, and occupation.

Ans. David Thayer, M. D.; sixty; Boston; physician and surgeon.

Int. 2. Did you ever know Dr. John A. Cummings, of Boston; and if yea, for how long a time?

Ans. Yes; from 1833 or 1834 to the time of his death.

Int. 3. Please state whether you knew him intimately, and what your relation was, if any, with him.

Ans. Very intimately. He was my brother-in-law, he having married my sister; his first wife was my sister.

Int. 4. Was your acquaintance with him of such a character as to enable you to know what his pecuniary condition was? And if so, please state during what period you had such knowledge.

Ans. Yes; I knew him so intimately from 1843 to the time of his death.

Int. 5. What was his pecuniary condition, as known to you, from 1855 to 1864?

Ans. Generally embarrassed as to his finances; in need of money; so much so that he frequently borrowed of me.

Int. 6. After 1855 did his pecuniary condition improve as the years rolled on?

Ans. No; I think he was more embarrassed.

Int. 7. State whether or not he ever borrowed money of you or gave you other evidence that his circumstances were straitened between 1856 and 1864.

(Objected to.)

165 Ans. He did, often and frequently.

Int. 8. Were your relations with him as a physician such to enable you to know his physical condition from 1856 to the time of his death?

Ans. Yes.

Int. 9. Please state what was his state of health during that period.

Ans. His health was feeble; he had a very distressing scrofulous eruption about the scrotum and nates, and a fistula near the rectum which never healed.

Int 10. How early had this become serious?

Ans. I can't fix the time now. I know it was very serious when he lived at the Pavilion.

Int. 11. What effect, if any, had his disease on his capacity for business, especially upon his capacity for dentistry?

Ans. It interfered with the exercise of the duties of that profession by producing constant irritability.

Int. 12. Did his disease occasion physical pain; and if yea, to what extent?

Ans. Yes; to a great extent, always; it was constant. He used constant expressions indicating great distress.

Int. 13. Did you ever have knowledge of an invention in hard rubber dental plates made by Dr. Cummings? And, if yea, please state when, how, and from whom such knowledge was acquired.

Ans. Yes. I can't fix exactly the time; the knowledge was obtained from Dr. Cummings himself; I should say as early as 1856. He took me into his laboratory, and showed me some dental plates he had made; also some moulds or forms in which the dental plates would be shaped.

Int. 14. What kind of dental plates were these?

Ans. They were like Exhibit Flagg No. 1; sometimes darker and sometimes lighter.

Int. 15. Did he tell you what he was going to do in respect to this matter?

Ans. He said he was going to make a fortune out of it. This he said whenever he borrowed money of me.

Int. 16. After 1856, did you ever hear Dr. Cummings speak of his having applied for a patent for said invention? And, if yea, please state what he said.

(Objected to as irrelevant.)

166 Ans. Yes; and often complained of Ezra Lincoln, because he did not obtain his patent for him; thought he was negligent.

Int. 17. Did this subject seem to occupy his thoughts to any extent; and, if yea, to what extent, and for how long, and during what period?

Ans. Yes; all the time during the period I have been speaking of, from 1856 up to the time he got his patent, and ever afterwards as well.

Int. 18. From 1856 to 1864, how often were you in the habit of seeing Dr. Cummings?

Ans. I was in the habit of seeing him constantly.

Int. 19. How frequently, when you saw him between 1856 and 1864, did he refer to this invention, or say he was going to get a patent, or words to like effect?

(Objected to as leading and incompetent.)

Ans. Most every time when we spent any time together.

Int. 20. What do you consider to be the cause, from your knowledge of Dr. Cummings's affairs, of their gradual decay.

Ans. His ill health and rather negligent habits. He thought he was going to have a fortune by and by, and he prepared for it.

Int. 21. Between 1859 and 1864 did Dr. Cummings borrow money of you? And, if yea, state whether in large sums or small, and whether he ever repaid them, and under what circumstances.

Ans. Yes; he often borrowed money of me in small sums, and he repaid all, but the circumstance of the payment I don't remember.

Int. 22. Were these payments before or after the granting of his patent?

Ans. Some before and some after.

Cross-examination by HENRY BALDWIN, jr., esq., of counsel for defendant:

Cross-int. 23. You were examined as a witness respecting Dr. Cummings's physical condition in the Wetherbee case, were you not?

Ans. Yes.

Cross-int. 24. Did you state then that you attributed his mental con-

dition to, in the first place, hereditary scrofulous constitution; also a strong tendency to pulmonary consumption; also his irregular and intemperate habits, and which, in your opinion, have prolonged his life, yet impaired his mind, and was that true?

Ans. Yes.

167 Redirect resumed:

Int. 25. This deposition referred to in the last answer was made on July 15th, 1865, was it not?

Ans. Yes.

Int. 26. And it referred, did it not, to his bodily and mental condition and habits at that time?

Ans. Yes.

Cross resumed:

Cross-int. 27. In your last answer, you mean at that time and theretofore?

Ans. Yes. I mean immediately theretofore.

DAVID THAYER.

Attest:

JOHN G. STETSON,
Examiner.

Deposition of Frances M. Cummings.

BOSTON, *December* 4, 1873.

My name is Frances M. Cummings. I reside in Boston. I am the widow of Dr. John A. Cummings, to whom certain letters patent were granted for an improvement in artificial palates and gums for inserting artificial teeth, dated the seventh day of June, 1864. I remember the circumstance of Dr. Cummings applying for a patent for this invention in 1855. I also remember that it was rejected at the Patent Office in February, 1855. Between the time that Dr. Cummings's application for a patent was so rejected and the time when the patent was granted I am able positively to state what was Dr. Cummings's disposition and intention in respect to asserting his claim for a patent for such invention. From the first moment that he conceived the idea that rubber could be used for plates for teeth, he never intended to give it up. It was only for the want of means that he was prevented from going on and getting his patent. He constantly said that he should get it, because it was his right.

He was so sure of success that he laid plans as to what he would do when the application was granted. This continued from the rejection of his application until the time when he got his patent. Everything had reference to that. Every plan that he made during that whole period had reference to it.

Our means being limited, I had to work hard; but he assured me that I would be well repaid, and live very differently when he got his patent. From the time of the rejection of Dr. Cummings's applica-

168 tion, in 1856, down to the time when he finally got his patent, he was a poor man. He could not prosecute his application; he could not do anything for want of means. He constantly said that though his hands were tied he was not discouraged; that he should get his patent yet. After 1860, when Dr. Cummings dissolved partnership with Dr. Flagg, his health was very poor, and we went up to the farm which I owned, in Dunstable. He was very poor at that time.

We staid there until November, and then returned to my house in Boston, and took boarders. The mortgage on my house became due next October, and I was obliged to sell it. I received in money only $930 over and above the mortgage and expenses, and this I used to pay our living expenses. I sold all the best of my furniture but one mirror, and that was taken for debt. This was when the doctor went into business, which was after I had taken rooms in Tremont street. The mirror was put into his new office, and was taken, with his dental instruments, for debt. I think this was in 1862. He was only in business for a few months. His health was so poor that he could not practice dentistry; and, not having the means to support his family, we went up to the farm July 5th, 1862, and stayed there two years, lacking three months, and returned in April, 1864, to Boston.

I took a house April 1, 1864, No. 1 Asylum street, and supported my family for three years by taking lodgers. Mr. Alfred Randall went security for rent. I paid every bill. Dr. Cummings's health was feeble all the time, and he was unable to do anything. This continued down to the time when he began to realize something on his patent. The farm which I spoke of, at Dunstable, was mine, given me by my husband in exchange for a house which was left me by my father, which he had taken and disposed of to raise money as early as 1848, 1849, or 1850. As early as 1856 the farm was heavily mortgaged to raise money to live on, and I went to the mortgagee and begged him not to foreclose. This I did repeatedly, both before and after my residence at the farm, in 1860, and on one occasion I pawned my diamond ring to pay the interest. During the whole period, from the time of the rejection of the application in 1856 until a long time after he got the patent, I lived in the most economical manner. We never had any money. From 1856 to 1860, when we went on the farm, we were boarding, and had but one room, and lived very frugally, and had very little money. We were very poor, and kept getting worse. The first summer on the
169 farm, in 1860, we were obliged to rent out the farm on halves to people who lived in the same house with us and helped defray the expenses. We got so that we could not stay there because we had no money to pay daily expenses with. I had to pawn my watch and jewelry for mere living expenses; and when I kept boarders in my house in Boston, in 1861, I had so little money that the mortgagee actually remitted the interest, amounting to one hundred and twenty-five dollars, out of pity, because I was utterly unable to pay it; but at last it had to be sold. In the last part of 1861 and first part of 1862, when we had rooms in Tremont street, I actually did my own washing, and sometimes we even suffered for want of food. During the succeeding two years when we lived at the farm, we did all our own work; had no servant, nor had we any during the previous times spoken of.

During all this time Dr. Cummings was unable to eat with the rest of the family, except very seldom, on account of his feeble health; and I was unable to have a nurse, as I could not afford it. Indeed, while I took boarders in Boston I could afford but one servant. I cannot begin to tell all the hardships which we endured during the whole period, from straitened circumstances, and sometimes even for the want of the necessaries of life. But for all this, Dr. Cummings never for a moment abandoned hope and intention of getting his patent. It was a by-word, until I hated the very name of rubber. With all these discouragements, he never gave up hope, but constantly said, "I shall get my case yet." Whenever a friend came in that would be the general topic of conver-

sation during the whole period, from the time of his invention until he finally got his patent.

(Cross-examination waived, it being admitted on the part of complainants that this witness now owns one thousand shares of the capital stock of the Goodyear Dental Vulcanite Company, this complainant corporation.)

FRANCES M. CUMMINGS.

Attest:

JOHN G. STETSON, *Examiner.*

(Counsel for defendant deems it proper to state upon the record that the cross-examination of this witness is foreborne solely upon the ground of deference to the witness as a lady, whose feelings would naturally be severely tried by the class of questions necessarily involved in a cross-examination upon some of the matters referred to in her deposition.)

170 *Deposition of Josiah Bacon.*

BOSTON, *Dec.* 4, 1873.

Direct examination by BENJAMIN F. LEE, Esq., of counsel for complainant:

Int. 1. Please state your name, age, residence, and occupation.

Ans. Josiah Bacon; 41; Boston; treasurer Goodyear Dental Vulcanite Company, complainants.

Int. 2. How long have you been such treasurer?

Ans. Since the incorporation of the Goodyear Dental Vulcanite Company.

Int. 3. Prior to that time what was your occupation?

Ans. I was, since 1864, the treasurer of the Dental Vulcanite Company.

Int. 4. Did you know Dr. John A. Cummings, of Boston? And, if yea, state how and when you first became acquainted with him.

Ans. I was introduced to him in, I think, June, 1863. He had then just received his patent, and sought me, at the instance of mutual friends, for advice and services, to make his patent most available to himself.

Int. 5. Had you any means at that time of knowing the pecuniary condition of Dr. Cummings? And, if yea, please state fully your knowledge on the subject.

Ans. From personal call at his residence I saw his pecuniary condition displayed, from the fact that his wife was keeping a lodging-house for their mutual support. From himself I learned his pecuniary condition, at an early stage of our acquaintance, by his borrowing of me, only a few days after I first met him, a few dollars to purchase underclothing, confessing himself to me utterly without means.

Int. 6. Please state whether you ever acquired knowledge that Dr. Cummings was in debt at the time you were first introduced to him; and state fully your means of knowledge on the subject.

(Objected to as not the best evidence of the fact inquired about.)

Ans. Only a few days after making his acquaintance the doctor informed me that he was unfortunate in owing many small debts; and stated that it would give him the greatest possible pleasure could I so arrange his business and patent affairs to pay off the "uttermost
171 farthing" of those debts; and he did, after his patent was placed in such shape that he received pecuniary benefit therefrom, pay

off debts long outlawed, through my instrumentality. To some parties I conveyed stock in the Dental Vulcanite Company from the doctor to liquidate such debts; to other parties he paid cash, obtained from stock which I sold for him, to liquidate others.

Int. 7. How many dentists have taken license under the patent on which this suit is brought?

(Objected to as new matter, enlarging complainants' case in chief and not in rebuttal of any proof offered by defendant.)

Ans. I think nearly seven thousand (7,000) have settled with the company and had license since its organization.

Int. 8. Look upon the article now shown to you, and state what it is.

Ans. It is a partial dental plate of hard rubber or vulcanite, having one tooth attached.

Int. 9. Please state by whom it was made.

Ans. It was made, I think, by C. W. Estabrook, of Worcester, Mass.

Int. 10. When was it made?

Ans. I think three years ago.

Int. 11. For what purpose was it made?

Ans. Dr. Estabrooks having stated to our agent, when he called for the purpose of licensing Dr. Estabrook, that he did not use rubber, the plate was made for a patient whom I ordered sent to him, to test the sincerity of his statement. It was made for that patient's use.

(Complainants' counsel offers in evidence exhibit marked Exhibit Josiah Bacon No. 1, J. G. S., Examiner.)

Cross-examination by HENRY BALDWIN, Jr., Esq., of counsel for defendant, reserving the objections stated:

Cross int. 12. What is the business conducted under the Goodyear Dental Vulcanite Company incorporation?

Ans. Mainly selling licenses to dentists to manufacture vulcanite plates under the company's patent.

Cross int. 13. Isn't that its sole business?

Ans. It is not.

Cross-int. 14. What else?

Ans. Selling dental plates ourselves, if ordered.

Cross-int. 15. Has a dental plate ever been ordered from or sold by the Goodyear Dental Vulcanite Company; if yea, when, and to whom?

172 Ans. I have had patients come into this office, supposing that the plates were made in these rooms, and order or request a vulcanite plate made for them. Such patients I have usually referred to Drs. Flagg and Osgood, who were, by vote of the company, long ago made its manufacturing agents.

Cross-int. 16. Is that the nearest the company has come to manufacturing plates?

Ans. Unquestionably yea.

Cross-int. 17. Were Flagg & Osgood licensees of the company when they were appointed agents?

Ans. They have always held license, but whether they were at the precise moment of the vote being passed, I cannot remember. They certainly have always been licensees.

Cross-int. 18. Has this company had, at any time, any interest in Flagg & Osgood's business as dentists or makers of these plates?

Ans. Not in their general business as dentists; but they agreed to pay a commission upon all business sent them. I mean vulcanite plate business.

Cross-int. 19. How many customers or patients have been referred by the company to Flagg & Osgood under this arrangement?

Ans. I really cannot tell; perhaps a dozen or more. It was so small a matter I kept no account thereof.

Cross-int. 20. And they paid no commission in fact?

Ans. No; it was so small a matter, as I have before said, that no account was made of it.

Cross-int. 21. When did you last have such an application to the company for a plate?

Ans. Only a few months since.

Cross-int. 22. Is this Mr. Flagg, of Flagg & Osgood, Mr. G. H. P. Flagg, who was examined herein as a witness on Tuesday last (Dec. 2)?

Ans. He is.

Cross-int. 23. What was the Dental Vulcanite Company that preceded this corporation?

(Objected to.)

Ans. A corporation formed for the ownership and management of the Cummings patent.

Cross-int. 24. How long were you treasurer of that company?

Ans. From its organization, Aug. 1st, 1864, to Dec. 21st, 1867, when present corporation was formed.

173 Cross-int. 25. (De bene esse.) How many of the seven thousand dentists (7,000) that have settled and had license under the patent under which this suit was brought were also licensed under the Nelson Goodyear patent of 1851, reissued May, 1858?

Ans. I think at least three-quarters thereof.

Cross-int. 26. Up to May 6, 1872, didn't all the licenses granted by the Goodyear Dental Vulcanite Company recite and grant under the said Goodyear reissues as well as under the patent on which this suit is brought?

Ans. They certainly recited both Goodyear & Cummings patents.

Cross-int. 27. Please produce, to be annexed as an exhibit, a blank license, such as issued by this company prior to May 6, 1872, and also a blank such as issued since then.

(Witness produces two blank licenses as requested, which are marked, respectively, Exhibit Josiah Bacon No. 2, 1872, and Exhibit Josiah Bacon No. 3, 1873.)

Cross-int. 28. How many licenses like Exhibit Bacon No. 2 did you as treasurer issue prior to January 1st, 1873, and after January 1st, 1872?

Ans. I think between four and five thousand.

Cross-int. 29. Do you know how this plate, Complainants' Exhibit Josiah Bacon No. 1, was worn or to be worn?

Ans. In the mouth, of course.

Cross-int. 30. Do you know whether the indentations in the edge of that plate were to fit round the natural teeth remaining in the mouth on either side of the tooth in the plate?

Ans. I presume they were, as an impression of the mouth is taken always, from which they manufacture a plate.

Cross-int. 31. Can you tell, from seeing a hard rubber dental plate, how it was made?

(Objected to as not proper cross-examination and as incompetent.)

Ans. When I see a rubber denture I presume it was made in accordance with reissue No. 1904, as I believe there to be no other known method of making a rubber vulcanite plate.

Cross-int. 32. Do you presume, for the reason just given, that this Exhibit, Bacon No. 1, was made in accordance with reissue 1904?

(Same objection.)

174 Ans. Dr. Estabrook, the maker thereof, admitted that it was so made.

Cross-int. 33. Was that before or after you first saw this exhibit?

Ans. After I saw it.

Cross-int. 34. When you first saw this plate, Exhibit Bacon No. 1, did you presume that it had been made as Dr. Estabrook afterwards admitted that fact?

(Same objection as to cross-interrogatory 31.)

Ans. I did.

Cross-int. 35. Why did you want to test the sincerity of Dr. Estabrook's statement that he didn't use rubber?

Ans. Because he was without license, and I wished to see if he was an infringer.

Cross-int. 36. An infringer of the Cummings patent 1904?

Ans. Yes.

Cross-int. 37. Now, when you saw this plate first, were you satisfied that it was an infringement of 1904?

(Same objection as to cross-interrogatory 31.)

Ans. I firmly believed it to be such.

Cross-int. 38. Without reference to the way in which it was made?

(Same objection.)

Ans. Certainly.

Cross-int. 39. Then do you consider that a plate of hard rubber or vulcanite for holding artificial teeth, or teeth and gums, however made, an infringement of the Cummings patent 1904?

(Same objection.)

Ans. From my position as manager of this company, and my constant intercourse with the dental profession, it could not fail to come to my knowledge were any other method of making a dental plate of vulcanite known; and none other method than that described in reissue 1904 has ever been made known to me.

Cross-int. 40. Did you charge Dr. Estabrook with infringement of 1904 when you got the admission as to how Exhibit Bacon No. 1 was made?

Ans. I presume I did, as I usually do in such case.

Cross-int. 41. Do you mean that when you see a hard-rubber dental plate you assume infringement of 1904 without inquiring as to how it was made?

175 (Same objection as to cross-interrogatory 31.)

Ans. I do.

Cross-int. 42. Specify what debts you paid off for Dr. Cummings, and the amount of them.

Ans. Being nearly ten years since, I can remember but a few names, and no amounts. I will name Horace Jenkins, A. B. Wilbur (not the witness examined in this case), a Mr. Niles, I think, a Mr. Seward, Mr. Randall, Mr. Martin, Mr. Prescott, Mr. McGilerny, Codman & Shurtleff (the dental depot men), A. B. Child, Mr. Wallace. There were others, but I can't recall them now. Some of the above were paid in the office in my presence by Dr. Cummings; others he obtained the stock or money therefor from me, telling me it was for the payment of old debts. The amount it would be impossible for me to give, but I think it must have been in the neighborhood of four or five thousand dollars altogether.

Cross-int. 43. You say some of these debts had become outlawed; I presume you mean by lapse of time?

Ans. I do so mean, being so informed by Dr. Cummings.

Cross-int. 44. From this time in 1864, when you made Dr. Cummings's acquaintance, until the time of his death, did you know his affairs generally?

Ans. I did generally, and only generally.

Cross-int. 45. Didn't he engage during that time in a water-cure enterprise?

Ans. Not to my knowledge, nor do I think it possible he could have done so without my knowledge.

Cross-int. 46. Have you been, and are you now, a stockholder in this Goodyear Dental Vulcanite Company; and, if yea, to what extent?

Ans. At present I am the owner of one share. I have owned several hundred at different times, being constantly speculating therein when proper opportunity offered.

Direct examination resumed:

Int. 47. During the time that you were treasurer of the Dental Vulcanite Company, under what patent did you grant licenses to dentists as such treasurer?

Ans. Solely under the Cummings patent.

Int. 48. Have Flagg and Osgood, during the time that they had license under the Cummings patent, paid a license-fee; and, if yea, to what amount?

176 Ans. They have every year, and about four hundred ($400) per annum, varying in different years.

JOSIAH BACON.

Attest:

JOHN G. STETSON,
Examiner.

Evidence for complainants in reply. Taken in Washington, D. C., de bene esse, on notice, before Andrew C. Bradley, U. S. Commissioner.

WASHINGTON, D. C., *Nov.* 25, 1873.

Present, Benjamin F. Lee, esq., of counsel for complainants; Henry Baldwin, jr., esq., of counsel for defendants.

Before Andrew C. Bradley, U. S. Commissioner.

Deposition of Anthony Pollok.

Direct examination by BENJAMIN F. LEE, Esq., of counsel for complainants:

Int. 1. What is your name, age, residence, and occupation?

Ans. Anthony Pollok. I am in my forty-fourth year. I reside in Washington, D. C.; and I am an attorney and counsellor at law.

Int. 2. To what branch of the law have you given your particular attention?

Ans. Patent law.

Int. 3. In the letters patent of the United States, granted June 7, 1864, No. 43009, for improvement in artificial gums and palate, you appear to have been the attorney by whom the application was prosecuted. Please state fully what connection, if any, you had at any time prior to the granting of said letters patent with the invention embraced therein.

(Defendant's counsel objects to the question as incompetent, and

inquires of counsel for complainants what part of defendant's proof it is proposed to rebut by the evidence of this witness.

Counsel for complainants calls attention to that part of defendant's record wherein public use of the invention which is the subject of the letters patent on which this suit is proven prior to 1864.

Counsel for defendant now objects to the evidence proposed as not in rebuttal, but as simply an enlargement (and as such inadmissable)
177 of complainants' case in chief, the complainants having then put in evidence the file and contents of the application for the patent 43009, and the file and contents of the application filed in 1855, cannot now supplement the same by anything that transpired between the two, neither of them having been referred to in the course of defendant's proof, and this objection will be duly submitted and insisted upon at or before the hearing of this cause, as the rules of the court may require.)

Ans. The first knowledge I had of the invention which is the subject-matter of the letters patent, referred to in the interrogatory, was some time in the month of February, 1859, when, in due course of mail, I received a letter from Mr. Ezra Lincoln, of Boston, now deceased, then my correspondent, in which letter I was requested to make an examination of an application of Dr. J. A. Cummings, for patent for improvement in artificial palates, to see if on an appeal to the board a patent could be secured. I would here state that the Commissioner then in charge of the Patent Office had created a board of examiners, to whom cases on appeal were referred for final decision, or rather for a decision which was approved by the Commissioner and thus became final. The letter enclosed a power of attorney which enabled me to act on behalf of Mr. Lincoln, the attorney of record of J. A. Cummings. Both the letter and the power of attorney I herewith produce. They are both in Mr. Lincoln's handwriting, with which I am perfectly familiar.

(Complainants' counsel here offers the letter and power of attorney, referred to in evidence, and the same are marked Exhibits Pollok No. 1 and Pollok No. 2.

Defendant's counsel objects to each of said exhibits as incompetent and irrelevant.)

On receipt of the letter, Exhibit Pollok No. 1, which I believe was on the 18th of February, I immediately proceeded to the Patent Office, and made a thorough examination of the case, and having made myself familiar with the action that was had on the application, and carefully considered the reference cited by the examiner in answer to said application, and of which I took a memorandum at that time on the back of Mr. Lincoln's letter, as appears on the back of Exhibit No. 1, I went before the Commissioner and moved that the case might be referred to the board, insisting, as well as I could, that great injustice had been done to the applicant. The Commissioner, Mr. Holt, however, was averse to
178 having the case referred to the board, and denied my motion. Thereupon I made my report to Mr. Lincoln in a letter dated February 19th, 1859, of which I have a press copy in my possession. The letter was written by myself in my own handwriting. I would say that I was quite prompt in attending to this business. I received Mr. Lincoln's letter on the 18th, and acknowledged the receipt of it on that day, as will appear from another press copy of a letter written by me on the 18th of February, 1859, which I have in my possession. Both of those letters were mailed by me and I have reason to know that they were received by Mr. Lincoln in due course of mail.

(Complainants' counsel here offers in evidence the press copies of two

letters referred to by the witness, and the same are marked Exhibit Pollok No. 3 and Exhibit Pollok No. 4.

Defendant's counsel objects to each exhibit as incompetent and irrelevant, but waives any objection as to the use of the press copies in place of the originals.)

Int. 4. After February 19, 1859, did you ever have any conversations with Mr. Ezra Lincoln in relation to the said application of John A. Cummings? and, if yea, please state the substance of such conversations and the circumstances under which they took place.

(Objected to as inadmissable, upon the general grounds herein first stated, and as incompetent and irrelevant.)

Ans. I did have frequent conversations with Mr. Lincoln. In the years '59, '60, and '61, my business brought me very often in contact with Mr. Lincoln, in the city of Boston. The office of Mr. Lincoln I was in the habit of making my headquarters, and I visited Mr. Lincoln frequently at his house, on which occasions we discussed business generally. In my conversations with Mr. Lincoln on the subject of the Cummings application, he expressed himself profoundly disappointed at the course which the case had taken in the Patent Office, and at the refusal of the Commissioner to grant a rehearing. He seemed to me to have taken more interest in this case than I had known him to take in almost any other case that he had been interested in. He spoke of Dr. Cummings as a personal friend, and as a man who occupied a high position in his profession, and who had become infatuated with this invention to such an extent that he was unfit to pursue what he thought to be his legitimate business. Mr. Lincoln, when urged by me to renew the application
of Dr. Cummings, expressed his regret at his inability to do so,
179 because of Dr. Cummings's poverty, and inability to advance the government fee. I cannot possibly say how frequent those conversations were. I can only say they have left an impression upon my mind as to having been frequent. Nor do I know when the last conversation on this subject took place, but I do know that it was between the fourth of March, 1861, and June, 1863, for I remember distinctly that one of those conversations took place after Mr. Lincoln had been appointed assistant treasurer of the United States during President Lincoln's administration, and while Mr. Ezra Lincoln occupied the office in the custom house in Boston, and when he had moved his house to Commonwealth avenue, where I visited him. Mr. Lincoln at that time had virtually withdrawn from the patent business, although it was still conducted in his name, and I believe in his interest, and he relied mainly upon me to look after Mr. Gavett, who had charge of his business, and I recollect his asking me, I am sure more than once, whether Mr. Gavett had done anything for Dr. Cummings. I know that it was not after June, 1863, for that was the time Mr. Lincoln died.

Cross examination:

Reserving the objections taken, council for defendant puts the following cross-interrogatories de bene esse:

Cross-int. 5. When you made the application for the patent No. 43009, Mr. Lincoln was dead, was he not?

Ans. He was.

Cross-int. 6. Was Mr. Gavett dead then?

Ans. He was not.

Cross-int. 7. Is he dead now?

Ans. He is. I don't know when he died. I lost sight of him a long

time (a year or so) before he died, and did not know of his death until some time afterwards.

Cross-int. 8. Did you prepare the papers for the application for the patent No. 43009?

Ans. I have no recollection at this distance. If it is an object to ascertain this I can make the necessary investigation. If the papers were prepared by me I would still have the draught of them among my papers, which I have carefully preserved.

Cross-int. 9. Can you not state from recollection whether or not you prepared the papers for that application?

Ans. The preparing of the papers for application for patents was my daily occupation for many years past; that is, from 1853 or 1854 to about three years ago, so that it would be impossible for me
180 at this time to recollect any particular instance unless such preparation was coupled with extraordinary circumstances. But I think I could, on reading the specification or examining the papers, state whether they were prepared by me or not. I have no recollection whether I did prepare the papers in the Cummings application referred to.

Cross-int. 10. Have you stated all that transpired within your knowledge between the time of Mr. Lincoln's death, or of your last interview with him, referred to, and the application which you prosecuted, and which resulted in the issue of the patent 43009?

Ans. I am not aware that I have stated anything of what has transpired, within my knowledge, between the times stated in the interrogatory.

Cross-int. 11. Have you not stated "fully your connection prior to the granting of said letters patent with the invention embraced therein"?

Ans. What I have stated in regard to this related to my connection therewith prior to the granting of said letters patent, but did not extend beyond the time Mr. Lincoln's own connection with the case ceased.

Cross-int. 12. Have you stated all that transpired between you and Mr. Lincoln, in connection with Dr. Cummings's original application?

Ans. Probably not; I stated only so far as I am able at this moment to recollect.

Cross-int. 13. Have you stated all that you can now recollect?

Ans. Without my attention being specially directed to particular circumstances, I could not say what I may or may not be able to recollect at this time in regard to what had transpired between me and Mr. Lincoln in connection with Dr. Cummings's application.

Cross-int. 14. Do you recollect anything beyond the correspondence and conversations you have mentioned, between yourself and Mr. Lincoln?

Ans. I remember having seen several times, I could not say how often, Dr. Cummings himself. He called on Mr. Lincoln while I was there at the office; he was generally looked upon as a perfect bore.

Cross-int. 15. When you prosecuted the application for the patent 43009, had you any interest in the invention or patent to be obtained therefor.

Ans. I had no interest whatever in the invention or patent.

181 Cross-int. 16. Are you a stockholder in the Goodyear Dental Vulcanite Company, one of these complainants?

Ans. I am.

Cross-int. 17. To a considerable amount?

Ans. It is not a considerable amount; the exact amount can be easily ascertained by reference to the stock-book in custody of Mr. Josiah Bacon, the treasurer of the company, and one of the complainants in this cause.

Redirect.

Int. 18. When did you first become in any way pecuniarily interested in the Cummings patent?

Ans. After the hard-rubber patent of Nelson Goodyear was extended. About a year or so thereafter, or about seven years ago, certain personal friends of mine had acquired the exclusive right for dental purposes to the hard rubber invention under the extended term of the patent, and I was induced to take an interest in that license or right, for which I paid my proportion in money. That right was eventually transferred to the Goodyear Dental Vulcanite Company, for a certain amount of stock issued in payment therefor, and I obtained for my share the proportionate amount of stock, which remained in the hands of the president of said company ever since.

Int. 19. Can you recollect the number of shares of stock of the Goodyear Dental Vulcanite Company that you hold?

Ans. I cannot.

A. POLLOK.

Exhibit Pollok No. 1.

BOSTON, *Feb'y* 15, 1859.

MY DEAR POLLOK: I am at home again "thank God!" but with a return of my disease in the shape of inflam'ation in my toe. However, I hope for patience for all it is designed I should. I send you a check for $30, for Cheever's case procured, & $5 for examining an application to see if, on an appeal to the board, a patent can be secured. The application is that of Dr. J. A. Cummings for an artificial palate and gums. I send the power of attorney within.

My kindest regards to the gen'l. Please write me soon and oblige,

Yrs., truly,

EZRA LINCOLN.

A. POLLOK, Esq.

182 (Endorsed:) Harris' Dictionary of Dental Surgery, 105; Am. Journal of Dental Science, vol. 2, series 2, page 332; Delabarre, single vol. 122, page 239.

Exhibit Pollok No. 2.

To Hon. J. HOLT, *Commiss. of Patents:*

Please allow A. Pollok, esq., to act in my stead in the case of Dr. J. A. Cummings' application for a patent for improv'ts in artificial palates, & oblige,

Your obdt.,

J. A. CUMMINGS,
By his att'y, EZRA LINCOLN.

Exhibit Pollok No. 3.

WASHINGTON, *Febr.* 18, 1859.

Col. E. LINCOLN:

MY DEAR SIR: Your favors of the 15th & 16th, the former inclosing

your draft for $35 for services on the Cheever apl for impr. in hose, & in the matter of Dr. J. A. Cummings' appl. (examination), the latter enclosing another check for $30 for attending M. Stimpson's appl. for patent for range have been received. I will reply to both more fully than I possibly could to-day by to morrow's mail. In the mean time believe me, yours, sincerely,

A. POLLOK.

Exhibit Pollok No. 4.

WASHINGTON, *Febr.* 19, 1859.

EZRA LINCOLN, Esq.:

MY DEAR SIR: I have carefully examined the application of Dr. Cummings, & I am sorry to say that the Commr. will not entertain an appeal to the board in the present state of the appl. Mr. Holt is very particular on this point, having received a severe rebuke in some of the N. Y. papers on account of his upsetting decisions rendered by his predecessor. Mr. Holt came out with a flat denial, & since that time nothing in the world will induce him to take up a case 3 times rejected.

I think there are good grounds for advising your client to renew his appl. on appeal, the Commr. having decided that the invention was not only described in Harris' Dictionary of Dental Surgery, but that there is evidence that the same had been used in England. In the same decision it is stated that the hard rubber was Nelson Goodyear invention.

183 Now, in comparing dates, we find that the palate described in Harris' dict. could not have been hard or hardened according to Goody. patent, for Goodyear invented the hardening of rubber in 1851, while Harris' dictionary was published in 1849.

Mr. Browne, of the Agricultural Bureau, will send you all that was published within 2 years about the growth of the sugar-cane. You mean, I suppose, the Chinese cane.

Yours, faithfully,

A. POLLOK.

Deposition of Edward C. Rushmore.

DECEMBER 10, 1873.

Direct examination by counsel for complainants:

Int. 1. What is your name, age, residence, and occupation?

Ans. Edward C. Rushmore; forty-three years of age; residence, No. 144 West 48th street, New York City; I am a dentist.

Int. 2. How long have you been a dentist?

Ans. Since 1857.

Int. 3. Have you made plates for holding artificial teeth? And, if yea, state generally your experience in such manufacture.

Ans. I have made plates for holding artificial teeth. I have made all kinds of plates. I have set teeth on gold; I have set teeth upon silver; I have set teeth upon platinum; I have set teeth upon tin alloy; I have set teeth upon gutta percha; I have set teeth upon vulcanite or hard rubber; I have set teeth upon cheoplastic.

Int. 4. Has the vulcanite dental plate special characteristics which distinguish it when in use from gold plates?

Ans. It has.

Int. 5. Please state particularly the special qualities which distinguish it from gold plates.

Ans. In the first place, its more perfect adaptability to the mouth; in the next place, its lightness or comparative weight; in the next place, its cleanliness; next, its comparative durability as regards strength.

Int. 6. Please state in detail how it is more perfectly adaptable to the mouth than a gold plate.

Ans. From the fact that in making a gold plate, or any other metallic substance, it is necessary to make metallic dies, either of zinc or of some combination of metals which are moulded in sand, and from which
184 a counter die or matrice is made of some softer material; lead is always used. The gold plate, platinum, and silver is then struck up between those dies. This process of moulding and striking up the plates never can be absolutely perfect.

Int. 7. Please state whether a more perfect adaptability to the mouth results from the nature of the material itself, apart from the mode of shaping by dies that you have spoken of in your last answer.

(Objected to as leading.)

Ans. Adaptability of what?

Int. 8. Of the rubber plate as distinguished from the gold plate.

(Same objection.)

Ans. I can answer that in two ways. First, it results first from the greater adaptability of the material itself; and, secondly, that it is moulded on the original transcript of the mouth.

Int. 9. Please state in what class of cases, if any, the lightness or comparative weight of the vulcanite dental plate, as spoken of in your answer to the 5th interrogatory, is of advantage.

Ans. In either full or partial upper sets.

Int. 10. Please state particularly what you mean by your expression "greater adaptability to the mouth."

Ans. I thought I had answered that in a previous answer. As compared with other materials in use for artificial bases, its greater adaptability consists in the fact that it is moulded in a soft nature or character, directly upon the original model of the mouth, not being subjected to the process of moulding and making duplicate models, which is necessary in making plates of any metallic character.

Int. 11. Please state what other material has the compacity to adapt itself to the minute peculiarities and depressions and prominences of the mouth.

(Objected to as leading and as assuming what the witness has not stated in respect to vulcanite.)

Ans. There is no other material used for dental purposes, of which I have any knowledge, that is equal to it in this respect.

Int. 12. Explain particularly how cleanliness is a special quality distinguishing the vulcanite dental plate.

Ans. The vulcanite or rubber being used in a plastic condition, its adaptability to the teeth from the pressure used is nearly perfect. The character of the material itself, after proper vulcanization, is absolutely impervious to moisture; whereas in gold plates, upon which either
185 single or gum teeth are set, the adaptation of the teeth to the plate, or the joints between the teeth, can never be made so perfect but that the secretions of the mouth will invariably find their way into the interstices, and thus cause them to be offensive.

Int. 13. State particularly the characteristics of the vulcanite dental plate in respect to its durability and strength; and in respect to its strength, state any experiment or test that you have applied in order to ascertain the same.

Ans. I think it is, so far as strength and durability are concerned, the best material now used for dental plates. The only test I have made of its comparative strength has been to stand upon a set of teeth of gold, platinum, or continuous gum and vulcanite, and have found that while the gold plate would be bent completely out of shape and the continuous gum fractured, that the vulcanite remained intact.

Int. 14. Can you produce a vulcanite dental plate, the strength of which you have tested in the manner described in your last answer?

Ans. This plate I recognize as my own, and which I have tested in the manner above described.

(Complainants offer in evidence the vulcanite dental plate referred to by the witness, and the same is marked Complainants' Exhibit Rushmore No. 1, December 10, 1873, J. A. S., examiner.)

Int. 15. I observed that in Complainants' Exhibit Rushmore No. 1 the porcelain composing the gum is cracked in some places; please state if you know how this thing occurred.

Ans. It occurred from my standing upon it with my full weight, and springing upon it.

Int. 16. In case a gold plate falls by accident upon a floor or other hard surface, what effect, if any, is produced upon the plate?

Ans. The probability is that it would be bent and thus rendered useless.

Int. 17. In case a like accident should happen to the dental vulcanite plate, what effect, if any, would be produced upon the plate?

(Objected to, the witness having stated the effect of the accident.)

Ans. The probabilities are that, falling upon the floor under like conditions, no injury would be done it.

Int. 18. For what purpose was Complainants' Exhibit Rushmore No. 1 made?

Ans. It was a practical case—made for a patient.

Int. 19. What special characteristic, if any, has the dental vulcanite plate in respect to elasticity as compared with other bases for artificial teeth?

186 (Objected to as leading.)

Ans. Compared with all metallic basis, its elasticity is comparatively greater—the metals, gold, silver, platinum, as used for bases for artificial teeth, having no elasticity whatever.

Int. 20. For the purpose of clamping to natural teeth, compare vulcanite with metal, and state the advantages, if any.

Ans. Use the word "clasping;" it is not clamping.

Int. 21. For the purpose of clasping to natural teeth, compare vulcanite with metal, and state the advantages, if any.

Ans. In ordinary cases, in partial sets of vulcanite, clasps of vulcanite are as durable as those made from metals. Its advantages are that it does not affect the tooth by mechanical action.

Int. 22. Please read Defendant's Exhibit No. 52, and state whether you have constructed, or tried to construct, a set of teeth upon a base of gutta-percha, according to the directions contained in said Exhibit No. 52.

Ans. I have made such a set of teeth, following absolutely the instructions laid down in that exhibit.

Int. 23. Will you please produce the set of teeth that you so made?

Ans. There is the set of teeth that I made in accordance with these directions.

(Set of teeth referred to by witness offered in evidence by complain-

ants' counsel, and same are marked "Complainants' Exhibit Rushmore, No. 2, Dec. 10, 1873, J. A. S., examiner.")

Int. 24. Please state whether you found it possible to make a set of teeth according to the directions contained in said Exhibit No. 52 which would be practically useful in the mouth for the purpose of mastication.

Ans. From the experiments that I have made, and placing the teeth in the mouth for that purpose, I think it is wholly impracticable. When I say that, I mean it might last for a day or a week, but not as a useful set of teeth to put in the mouth to wear.

Int. 25. How did that plate become broken, and with two of the teeth dislocated, as now it appears to be?

Ans. I saw Mr. Lee place it in water at the temperature of from ninety to ninety-two degrees Fahrenheit, and then it was broken in my presence, and I myself broke from the basis the teeth.

Int. 26. At the temperature of ninety-two degrees, what is the condition of gutta-percha as to its capacity to hold the teeth?

187 Ans. I have found that at that temperature, where a lever force was exerted, that it could not retain them; had no capacity whatever.

Int. 27. When this plate was taken out from water at ninety degrees, how much force was used to dislocate those teeth, and how were they, in fact, dislocated?

Ans. The first part of your question I cannot answer. I can't say how much force it was. It was done with my fingers, exercising not one-thousandth part of the force of the muscles of the jaws in masticating.

Cross-examination by counsel for defendant:

Cross-int. 28. Please produce some of the material of which you made the Exhibit Rushmore No. 2.

Ans. This is it. (Witness points to Exhibit Rushmore No. 2.)

Cross-int. 29. What is that material?

Ans. It is gutta-percha, sir—the ordinary gutta-percha of commerce. I might modify this by saying that the ordinary gutta-percha of commerce is in a crude state, and this is prepared for dental purposes.

Cross-int. 30. Do you know what the coloring matter is in this exhibit?

Ans. I do not.

Cross-int. 31. Please produce another piece of the material as it was when you commenced with it to make this Exhibit Rushmore No. 2.

Ans. I haven't any of it here.

Cross-int. 32. Is Exhibit Rushmore No. 2 made of a preparation of gutta-percha for dental purposes such as Complainants' Exhibit S. S. White?

Ans. I don't know, sir.

Cross-int. 33. How is the material of which that plate is made prepared for dental purposes?

Ans. I do not know, sir.

Cross-int. 34. What does it consist of?

Ans. Further than the gutta-percha itself, I do not know.

Cross-int. 35. How do you know that there is any gutta-percha in it?

Ans. I only know it from the fact that I purchased it at the dental depots, and it is represented to me as gutta-percha.

Cross-int. 36. Is there anything in it except gutta-percha?

Ans. I do not know.

188 Cross-int. 37. Do you know gutta-percha when you see it?

Ans. Only from my observation and knowledge of using it, as represented as gutta percha.

Cross-int. 38. Then you don't know that this Exhibit Rushmore No. 2 is made of gutta-percha, except that you bought it as a preparation for dental purposes?

Ans. I do not; relying wholly upon the manufacturer and dealer in it.

Cross-int. 39. Isn't it a preparation which is sold to dentists, and used by dentists for taking impressions or making trial plates?

Ans. It is a preparation used for trial plates; but I am not aware that it is ever used in the form now exhibited in Exhibit S. S. White for taking impressions.

Cross-int. 40. Did you make any addition to or change in the material after you bought it, other than the shaping of it?

Ans. I did not, sir.

Cross-int. 41. Do you know whether that material has not in it wax or some other ingredients for making it soften at a lower temperature than pure gutta-percha would?

Ans. I do not know.

Cross-int. 42. Is that plate made of the material that you understand to be mentioned in defendant's Exhibit No. 52?

Ans. Yes, sir; I do so understand it.

(Counsel for defendant requests the examiner at last to note upon the record his protest against suggestions, comments, and other interferences with the examination by Mr. Dickerson, except all such be noted as made.)

Cross-int. 43. Do you understand the temperature of one hundred degrees, mentioned in that Exhibit No. 52, to be degrees at Fahrenheit?

Ans. Not at all. Centigrade, I suppose, being a French translation.

Cross-int. 44. Did you warm this material to the temperature of one hundred degrees Centigrade in making this plate?

Ans. I warmed a portion of it at two hundred and twelve degrees Fahrenheit, which is a counterpart of one hundred Centigrade, and a portion which I placed over the teeth after they had been heated and placed in the material at one hundred and seventy.

Cross-int. 45. What kind of a material did you form this plate in by means of pressure suitably exercised?

189 Ans. That made of plaster of Paris.

Cross-int. 46. How did you make that matrice?

Ans. By first taking a plaster model of the mouth, moulding upon it wax about the thickness of the plate which I intended to make, then taking a counter-model of it in plaster, which made the matrice.

Cross-int. 47. Has that plate, Exhibit Rushmore No. 2, been worn in the mouth?

Ans. No, sir; it has not.

Cross-int. 48. Please produce the other two plates which you jumped upon as you did upon Exhibit Rushmore No. 1.

Ans. I cannot produce them, as I haven't them here.

Cross-int. 49. Where are they?

Ans. They are at my office.

Cross-int. 50. Will you produce them to-morrow morning to be annexed to your deposition, and present yourself to be further cross-examined respecting them when so produced?

(Counsel for complainants instructs the witness that he is not bound to produce any of his property to be impanelled in this case for the accom-'odation of the defendant, but he advises the witness, if the defendant wishes to purchase those teeth from him, that it will be perfectly proper

for him to sell them and permit the defendant to make them exhibits, if he chooses.)

Ans. I will produce them under the instructions of the complainant.

(Complainants' counsel instructs the witness that if he is properly compensated by the defendant for them, which is a matter for him to arrange with him, he should produce them; otherwise, not.)

Cross-int. 51. Are those two plates your property, doctor?

Ans. Yes, sir.

Cross int. 52. Haven't the complainants paid you for the damage done to them, or are they not to pay you?

(Objected to because the witness has not said that there was any damage done to those plates.)

Ans. I have had no pay at all for any damage done.

Cross-int. 53. Nor for the two other plates which you jumped on?

Ans. No, sir.

Cross int. 54. Did you stand or spring or jump upon the gold plate and the continuous-gum plate, as well as upon this Rushmore Exhibit No. 1?

190 Ans. I did not.

Cross-int. 55. What, then, do you mean when you say that you found while the gold plate would be bent completely out of shape and the continuous gum fractured, the vulcanite remained intact?

Ans. I mean just what I said then precisely, that I have done it.

Cross-int. 56. Did you do it at the time you tried this plate, Rushmore Exhibit No. 1?

Ans. I did not.

Cross-int. 57. When did you do it?

Ans. In 1868.

Cross-int. 58. How many vulcanite plates did you subject to the test which was applied to this Exhibit Rushmore No. 1, and when were these tests made?

Ans. I cannot tell you how many, but certainly two score, forty plates, which I have tested in the same manner; but at what times it is impossible for me to remember.

Cross-int. 59. When did you spring on this particular exhibit, Rushmore No. 1?

Ans. I did it last week a half dozen times, and yesterday in this office.

Cross-int. 60. Last week, or yesterday, did you test more plates than this one that way?

Ans. No, sir.

Cross int. 61. Is this plate, Rushmore No. 1, in the condition it was in yesterday after you tried the springing on it?

Ans. So far as I am able to judge, it is.

Cross int. 62. Was it in the same condition that it is now in before you tested it yesterday?

Ans. With the exception of the fracture in the front teeth and a loss of a portion of its parts, it is.

Cross-int. 63. Did your tests last week bring it to this condition with the exception just mentioned?

Ans. I hardly know how to answer that question. There is only one piece broken, and that was done yesterday.

Cross int. 64. Did you mean to say that this plate remained intact after you sprung upon it, as you have stated?

Ans. So far as I have examined the plate, I do say that no fracture

or other injury has been done to it since my standing upon it yesterday.

Cross-int. 65. Is that what you mean when you say, in your answer to question No. 13, "that the vulcanite remained intact"?

191 Ans. Intact expresses my meaning perfectly.

Cross-int. 66. You say that no fracture or other injury has been done to it since your standing upon it yesterday. Was any fracture or other injury done to it before your standing on it yesterday or last week?

Ans. Not that I am aware of.

Cross-int. 67. Did you examine that plate, after you tested it, at any time with a glass, so that you can testify that there is no fracture or other injury, and that it is intact?

Ans. I did examine that plate after my test of last week most thoroughly, and found that in its integrity it was perfect, but I did not examine it yesterday thoroughly.

Cross-int. 68. Please examine it now with the glass tendered you, and say if you find any fracture or other injury?

Adjourned.

DECEMBER 11, 1873.

Ans. I see that no injury has been done to the plate, with the exception of the very thin edge which covers the artificial gums, which is about one fiftieth part of an inch in thickness, is broken

Cross-int. 69. Is the plate, complainants' Exhibit Rushmore No. 1, in its present condition, fit for use in the mouth?

Ans. Well, sir, it is, with the exception that one of the blocks or sections is broken, and another of the sections, by the immense force exerted upon it in testing the strength of the basis, has become loosened.

Cross-int. 70. Cross-interrogatory No. 69 repeated.

Ans. That is the question which I have just answered.

Cross-int. 71. Please answer it further, and say whether Exhibit Rushmore No. 1, in its present condition, is fit for use in the mouth.

Ans. So far as the integrity of the plate is concerned, it is.

Cross-int. 72. Well, otherwise is it?

Ans. It is, if a person chose to wear a set of teeth the gums of which have been broken, the teeth themselves preserving their original contour. I will add there now, for all purposes for which artificial teeth are used, the plate just presented is as practicable in its character as it was when first made.

Cross-int. 73. How long have you been making the vulcanite dental plates?

Ans. Since its first introduction, or the beginning of my practice in 1857.

192 Cross-int. 74. Where did you use it first?

Ans. In New York City.

Cross-int. 75. Did you prepare the rubber yourself, or buy the compound ready for moulding?

Ans. I purchased it ready for moulding.

Cross-int. 76. Whose preparation of rubber was it that you used at that time?

Ans. It was, as I understand it, the Hard Rubber Company's preparation.

Cross-int. 77. Did they keep it on sale at that time in New York for that purpose?

Ans. I am not positive as to that year, 1857, whether it was on sale at the dental depots, but I had it put up for me. I can't remember the

name of the man who did it for me. I would like to modify my answer to the question as to the date. Without referring to my books, I cannot state, as I did in my previous answer, whether I commenced the use of vulcanite in 1857; but I can state positively that I did make that work in the fall and winter of 1860.

Cross-int. 78. Was this preparation similar to the sheet now shown you?

(Sheet referred to handed to witness by defendant's counsel.)

Ans. So far as its physical appearance is concerned, it is the same.

(Sheet offered in evidence by defendant's counsel, and marked Defendant's Exhibit Rubber Preparation, December 11, 1873, J. A. S., examiner.)

Cross-int. 79. How early did you set teeth upon platinum?

Ans. In 1857.

Cross-int. 80. Is platinum and continuous gum work the same thing?

Ans. Used in the sense of my answer to direct interrogatory No. 13, it is.

Cross-int. 81. Look at the plates now shown you, and say if they are pieces of platinum or continuous gum work, such as you have referred to.

Ans. They are.

(Said pieces offered in evidence by defendant's counsel, and marked respectively Defendant's Exhibits, Platinum or Continuous Gum, Upper Set, and Platinum and Continuous Gum, Lower Set, December 11, 1873, J. A. S., examiner.)

193 Cross int. 82. When did you set teeth upon silver first?

Ans. I cannot give you the precise date, or even year; but I think in 1854, while I was a student.

Cross-int. 83. Did you set the teeth on silver in the same way as you did on gold?

Ans. Yes, sir.

Cross-int. 84. When did you first set teeth upon tin alloy?

Ans. I have never set teeth upon tin alloy.

Cross-int. 85. Then you were wrong when you said that you had done so, in answer to int. 3?

Ans. So far as the word alloy is concerned.

Cross-int. 86. Did you set teeth upon tin?

Ans. I did.

Cross-int. 87. When first?

Ans. I cannot tell you at what date.

Cross-int. 88. State as near as you can.

Ans. I think about the year 1862.

Cross-int. 89. How did you do that?

Ans. By making a model in plaster from the counterpart of the mouth, placing the teeth in position upon wax or other basis, arranging them in the mouth to articulate with natural or artificial teeth, and from that basis and teeth making a mould of such plate and teeth in plaster, then melting the tin and casting it in the mould.

Cross-int. 90. Did the teeth you used in this work have pins in them?

Ans. They had, sir.

Cross-int. 91. When did you set teeth upon cheoplastic first?

Ans. I have never set teeth on cheoplastic.

Cross-int. 92. Then why did you say you had in your answer to int. 3? Explain.

Ans. I had them set for me.

Cross-int. 93. When first?

Ans. I cannot answer precisely, but I think in 1868.

Cross-int. 94. Do you know how that was done?

Ans. I do not positively know, but judge that it was done in the same manner as casting tin plates.

Cross-int. 95. When you tested the gold plate and the platinum or continuous-gum plate by standing on them, where did you put the plates?

Ans. I put the plates upon a floor covered with oil-cloth.

194 Cross-int. 96. Did you support those plates in any, and, if yea, in what way other than placing them on the floor?

Ans. No, sir.

Cross-int. 97. Is not a dental plate, when used in the mouth, supported by the part of the mouth to which it is fitted?

Ans. Do you mean that word supported as to the strength? It is, to a certain extent.

Cross-int. 98. Are not all dental plates fitted accurately to the mouth of the patient?

Ans. No, sir.

Cross-int. 99. Are they not intended to be so accurately fitted?

Ans. They are, sir; I presume.

Cross-int. 100. Isn't the accuracy of the fit a question of workmanship?

Ans. It is, sir.

Cross-int. 101. Were these two plates, the platinum or continuous gum, and the gold plate which you stood upon, each made for use in the mouth?

Ans. They were both practical cases; had been worn.

Cross-int. 102. Were they both strong enough?

Ans. They were.

Cross-int 103. Was that gold plate as thick as this plate, Exhibit Rushmore No. 1?

Ans. No, sir.

Cross-int. 104. Was it an entire set; and, if yea, upper or lower?

Ans. It was an entire upper set.

Cross-int. 105. What extent of experience have you had with these vulcanic dental plates?

Ans. I have used them since the date I have given here—1860, I think it was. I have made on an average since that time, probably, fifty cases a year.

Cross-int. 106. Haven't you also overhauled or repaired pieces made by other dentists?

Ans. I presume I may have done so.

Cross-int. 107. Have you overhauled or repaired vulcanite dental plates made by yourself or by others?

Ans. I have.

Cross-int. 108. After they had been in use in the mouth for some time?

195 Ans. I have.

Cross-int. 109. Ever removed the teeth from such plates?

Ans. When taken, yes.

Cross-int. 110. How did you remove the teeth in such cases?

Ans. By a blow from a hammer.

Cross-int. 111. That the only way?

Ans. I have sometimes crushed teeth in a vice.

Cross-int. 112. Do you mean that you could get the teeth out by a blow from a hammer, or by crushing them in a vice, without breaking or tearing the plate?

Ans. I do.

Cross-int. 113. Did the pins come out with the teeth or remain in the plate in such cases?

Ans. In some instances, when the proper vulcanization had not been accomplished, the pins were withdrawn from the plate; but when the work had been well done, the teeth broke from the pins, leaving them intact in the rubber.

Cross-int. 114. Did you have cases of your own work in which the proper vulcanization had not been accomplished?

Ans. I have had such.

Cross-int. 115. Have you ever used, in your vulcanized work, what you call the headed pins, that is, pins having heads on the ends which were imbedded in the plate?

Ans. I have.

Crosss-int. 116. Why did you use those pins?

Ans. On account of the greater strength.

Cross-int. 117. Look at the plates now shown you and say if they are vulcanite plates; and, if yea, whether, in your opinion, they are well made and fair specimens of vulcanite work, compared with such plates as you make of that work.

(Plates handed to witness by defendant's counsel.)

Ans. They are.

(Said plates offered in evidence, and marked respectively Defendant's Exhibit, Sample Plates Nos. 1 and 2, Dec. 11th, 1873, J. A. S., examiner.)

Cross int. 118. Have you not sometimes in lower sets occasion to load the vulcanite plate; and, if yea, how do you do that?

Ans. I have never had occasion to lower sets, but I have done so in several instances as a matter of experience. The process which I have employed has been to place a mass of tin in the plate.

196 Cross int. 119. Haven't you known of the vulcanite plates made by other dentists requiring to be loaded in special cases?

Ans. So far as the words "requiring to be" are concerned, I have not.

Cross-int. 120. So far as the fact that they were loaded, have you known such cases?

Ans. I have.

Cross-int. 121. Have not cases come under your notice in which sheet metal was used with the vulcanite upon it surrounding the teeth?

Ans. I have seen such.

Cross-int. 122. What was the object of that combination in the plate?

Ans. A more perfect joint between the teeth and the plate, and, in consequence, greater cleanliness.

Cross-int. 123. Then why not make the whole plate of vulcanite?

Ans. For the reasons, first, that the dentist making such plate of gold and rubber, or platinum and rubber, and thereby being enabled from the fact of using these metals in such combination could charge a much higher price than he could if made wholly of rubber; and, secondly, that some people requiring artificial denture have a prejudice against any substance other than the noble metal.

Cross-int. 124. Do you know of no other reason than those just given?

Ans. I do not.

Cross-int. 125. In such compound plates is the gold or the platinum as thick as the rubber would be in a vulcanite plate for the same case?

Ans. No, sir.

Cross-int. 126. Is the gold or the platinum as thick as the rubber which pins it to the teeth in these compound plates?

Ans. Of course not.

Redirect examination by counsel for defendant:

Int. 127. For how many years have you been using gutta percha in your practice?

Ans. I have used it in extreme cases of peril for seven years.

Int. 128. Where have you purchased it?

Ans. I have purchased it at the various dental depots.

Int. 129. Under what name is it sold at these depots?

Ans. Gutta-percha.

197 Int. 130. Have you bought it at Samuel S. White's depot?

Ans. I have.

Int. 131. Where do you buy the material which you use for making vulcanite plates?

Ans. I have purchased it from the different dental depots.

Int. 132. Under what name is it sold?

Ans. Rubber.

Int. 133. Do you know that it is rubber otherwise than as it is so represented, any more than you know that what you buy as gutta-percha is such?

Ans. I do not.

Int. 134. Have you any more doubt that the material used by you for making complainants' Exhibit Rushmore No. 2 is gutta-percha than you have that the material in complainants' Exhibit Rushmore No. 1 is vulcanite?

Ans. I have not.

Int. 135. For what purpose did you stand upon those forty vulcanite plates?

Ans. To test their strength.

Int. 136. What became of them afterwards?

Ans. Some of them were worn subsequently, and others, being temporary plates, and new plates substituted, I have in my possession.

Int. 137. Were they broken by the test thus applied to them?

Ans. I have broken some.

Int. 138. Were those broken which were subsequently worn?

Ans. No.

Int. 139. Did any one request you to subject Exhibit No. 1 to the test of standing on it, or was it your own volunteer to exhibit its strength?

Ans. It was voluntary on my part.

Int. 140. Do you think that the two plates, defendant's Exhibit Sample Plates Nos. 1 and 2, would bear your weight upon them without breaking?

Ans. I cannot tell without testing them.

(Counsel for complainants request counsel for defendant to permit Dr. Rushmore to try that experiment with one of those samples.

Counsel for defendant declines to have either of the samples subjected to the proposed experiment.)

Int. 141. What effect is produced by the fluids or gases of the mouth upon gutta-percha?

198 Ans. The fluids of the mouth act upon gutta-percha in such a manner that in a few weeks the surface of the gutta-percha plate becomes roughened and of a velvety character, so that it absorbs such fluids.

Int. 142. What is the consequence upon the gutta-percha in respect to its purity?

Ans. Of course it becomes offensive.

Int. 143. What effect do the fluids or gases of the mouth have upon vulcanite?

Ans. None whatever.

Int. 144. About what proportion of sets of artificial teeth, within your experience, are made of vulcanite?

Ans. I should say ninety-nine per cent.

Int. 145. What class of persons compose your patients, generally speaking?

(Objected to as new matter.)

Ans. The best families in New York.

Int. 146. Is the greater thickness of a vulcanite plate, as compared with a gold one, any practical objection to the use of vulcanite?

Ans. No, sir.

Int. 147. Which is heavier, a gold or a vulcanite plate, as practically made?

Ans. A gold plate.

Int. 148. When the vulcanite plate for the lower jaw is loaded with metal, is the metal covered up by the vulcanite?

Ans. It is, if well done.

Int. 149. Was that plate you spoke of made of pure tin?

Ans. It was purchased as such.

Int. 150. What was the result in practice?

Ans. It was successful, so far as the practicability of the plate and teeth were concerned; but, from the interstices between the metal and the teeth, it was impossible to keep it in a cleanly condition.

Int. 151. Why?

Ans. Of course it was from the shrinkage of the tin, therefore not being in direct apposition to the teeth.

Int. 152. In continuous gum sets, such as Defendant's Exhibits Platinum and Continuous Gum, etc., is the joint between the platinum enamel, in practice, within your experience, tight enough to exclude the fluids of the mouth?

Ans. It is, so long as the piece remains perfect.

199 Int. 153. In practice, does it remain perfect sufficiently to exclude the fluids of the mouth?

Ans. From its nature it is very liable to become fractured; and when such occurrence takes place, the body of the material, being of a porous nature, readily absorbs the secretions of the mouth, and becomes more or less offensive.

EDWARD C. RUSHMORE.

Attest:

JOHN A. SHIELDS,
Examiner.

Deposition of Alfred Randall.

DECEMBER 11, 1873.

Direct examination by counsel for complainants:

Int. 1. What is your name, age, residence, and occupation?

Ans. Alfred Randall; age, sixty-nine years; residence, Boston, Mass. I am doing no business now; have been a merchant and manufacturer.

Int. 2. Did you know Dr. John A. Cummings, of Boston; and if yea, for how long?

Ans. I knew him from 1845 to the time of his death.

Int. 3. Please give the date of his death.

Ans. Three years ago last March.

Int. 4. Do you remember a partnership that existed between Dr. Cummings and Dr. Geo. H. P. Flagg from 1855 to 1860?

Ans. I do.

Int. 5. Do you remember that Dr. Cummings obtained a patent for an improvement in hard-rubber dental plates, which was issued to him on the 7th day of June, 1864?

Ans. I do.

Int. 6. Did Dr. Cummings ever speak to you in reference to the invention which was the subject of that patent, prior to the time that he obtained the same?

Ans. Yes.

Int. 7. When did he first speak to you in relation to his said invention of hard-rubber dental plates, and what did he say in reference thereto?

Ans. Well, I should judge, about the year 1860—might be a little before or a little after that time. He said that if he had the
200 means to prosecute a patent which he had applied for he could make a fortune. He used to estimate it sometimes at half a million.

Int. 8. Between 1859 and 1864, how frequently did Dr. Cummings make such statements to you?

(Objected to as leading and immaterial, and irrelevant.)

Ans. Well, after 1860, it used to be as often as he had suitable opportunity.

Int. 9. About how often would that be?

Ans. Well, sometimes it would be nearly every day in a week, and sometimes there might be a week that there was nothing said about it. We were very intimate, and saw a great deal of each other.

Int. 10. State what efforts, if any, were made by Dr. Cummings to procure means to prosecute his application for a patent for his invention during the period you have mentioned.

Ans. His efforts were to try to induce some of his friends to take hold with him and advance the money to obtain his patent.

Int. 11. How did you know of those efforts?

Ans. He used to make the proposition to me, giving me a certain interest in the patent if he succeeded—one half interest.

Int. 12. How much were you to advance him for that one-half interest?

Ans. I was to furnish all the means required to establish it.

Int. 13. How often was this proposition made you?

Ans. It was very often; whenever he had suitable opportunity.

Int. 14. Did you advance any money to Dr. Cummings in pursuance of his request?

Ans. I did not.

Int. 15. State, if you know, how Dr. Cummings finally obtained means to prosecute his application.

Ans. He received it from Drs. Flagg and Osgood, he giving them a quarter interest.

Int. 16. What was the pecuniary condition of Dr. Cummings from the time of his dissolution of partnership with Dr. Flagg down to the time that he began to realize something from his patent?

Ans. His means were very limited, indeed.

Int. 17. Did he ever borrow money of you or give you other evidence of his straightened circumstances?

Ans. He did; both.

Int. 18. In the year 1864, do you remember that Dr. Cummings lived at No. 1 Asylum street, in the city of Boston?

Ans. Yes.

201 Int. 19. Please state the circumstances, if you know them, of his taking up his residence there.

Ans. Mrs. Cummings, the doctor's wife, thought that if they could get a house anywhere and go to keeping boarders, they might support themselves. She found a house on the corner of Washington and Asylum streets unoccupied. She went to see the owner, who told her she might have it for three years if she would get some one who would be responsible for the rent. She asked me if I would become responsible. I did so and they immediately moved into the house. She proceeded to take lodgers.

Int. 20. Was Dr. Cummings practising dentistry at that time?

Ans. I think he opened an office a few months afterwards.

Int. 21. Was he successful?

Ans. He was not.

ALFRED RANDALL.

Attest:

JOHN A. SHIELDS,
Examiner.

Exhibit Josiah Bacon, No. 2.—J. G. S., Examiner.

GOODYEAR DENTAL VULCANITE COMPANY.

License and agreement.

Whereas letters patent of the United States were lawfully granted unto Nelson Goodyear, bearing date the sixth day of May, 1851, for an improvement in the manufacture of India rubber and allied gums, of which improvement the said Goodyear was the first and original inventor; and

Whereas the said letters patent were lawfully surrendered, on account of a defective and insufficient specification, by Henry B. Goodyear, as administrator of the said Nelson Goodyear, deceased, and thereupon two new letters patent were duly granted for different parts of said invention, for the residue of the unexpired term for which the original letters patent were granted, one of said new patents being for the "new product, manufacture, or substance, known as the hard compound of vulcanized caoutchouc, or India rubber, and allied gums," and the other "for the improved process of producing the said product or substance;" both of which said new letters patent bear date the eighteenth day of May, 1858; and

Whereas both said reissued letters patent were in due form of law extended to the said Henry B. Goodyear, as administrator of the

202 said Nelson Goodyear, for another term of seven years, from the sixth day of May, 1865; and

Whereas the Goodyear Dental Vulcanite Company, a corporation legally organized under the laws of the State of New York, are the legal owners, by assignment, of the valid exclusive right, under the before-recited letters patent, of working the said process, and producing, applying and vending the said substance, as applied to dental purposes or dentistry, within the United States; and

Whereas letters patent of the United States were lawfully granted unto John A. Cummings, of Boston, bearing date June 7, 1864, "for an

improvement in artificial gums and palates," of which improvement the said Cummings is the first and original inventor; and

Whereas said letters patent were lawfully surrendered on account of a defective and insufficient specification, and were, on the tenth of January, 1865, lawfully re-issued to the Dental Vulcanite Company, a corporation duly established in Boston, Mass., who were the lawful assignees of the aforesaid patent and invention; and

Whereas said reissued letters patent were again lawfully surrendered on account of a defect in the specification, and were lawfully reissued on the twenty-first day of March, 1865, in due form of law, to said Dental Vulcanite Company; and

Whereas the Goodyear Dental Vulcanite Company aforesaid are the legal owners, by assignment, of the said reissue and the exclusive right to make, use, and vend the invention of said Cummings aforesaid; and

Whereas of , county of , and State of , is desirous of acquiring the right, privilege, or license of using the invention of said Nelson Goodyear, and the invention of said John A. Cummings, and of working the said process, and using the said substance for making artificial gums or plates for artificial teeth, according to the specifications of the letters patent above described; it being hereby expressly admitted, declared, and agreed by the said that each of the above-mentioned patents, under which the license hereinafter mentioned is granted and received, is valid and effectual in law to secure that exclusive right which each purports to secure:

Now, this agreement, made between the Goodyear Dental Vulcanite Company aforesaid, of the first part, and the said , of the second part, witnesseth:

203 The Goodyear Dental Vulcanite Company, for and in consideration of the sum of dollars, and the faithful performance by the party of the second part of the conditions herein specified, doth hereby grant to the party of the second part a right, privilege, or license, under the inventions of said Goodyear and Cummings, and the patents for the same, to use the said inventions for the production of artificial gums or plates for artificial teeth, in his own business as dentist, and for his own patients only, and for no other purpose, and to vend the gums and plates thus prepared to his own patients only, within the said of , and in such other place only as there may be no located licensee of the company, and not elsewhere during the time for which this license is granted, upon the following conditions:

First. That the said privilege or license shall not be assigned, sold, transferred, or otherwise disposed of in any manner.

Second. That the party of the second part shall not, by himself, his agents or servants, directly or indirectly, practice said inventions, or either of them, for, or vend said substance or said plates or gums for or to other dentists, nor in any way, except in his own business and for his own patients.

Third. That the said party of the second part shall in no manner countenance or encourage infringements on either of the patents or inventions above described, but shall at all times recognize the validity of said patents.

Fourth. That whenever said party of the second part shall furnish full and sufficient evidence, and produce the affidavits of witnesses, that any dentist in the city or town where the party of the second part

resides is infringing said patents, then the party of the first part shall commence proceedings against such infringing party, if he can be discovered, and prosecute the same in a reasonable manner, and by all reasonable and proper means.

Fifth. That the party of the second part, for and in consideration of the rights and privileges herein granted, hereby covenants and agrees to hold the within-granted rights and privileges subject to the terms and conditions herein specified; and that in case of failure on his part to comply with all or any of them, or the failure to pay at maturity any note given for past infringements or future license-fees, then this license shall be terminable at the election of the party of the first part, and upon a written or printed notice thereof, served upon the party of
204 the second part, or published in a paper having circulation in the county where the party of the second part resides or is doing business. And also, the party of the first part, if they so elect, may, in case of such breach and revocation of license, regard all the hard rubber work done by the party of the second part prior to such revocation as done, and said party agrees that it may be deemed and taken as done, without license and an infringement of each of said letters patent, and the party of the first part may proceed accordingly for injunction and account of profits as if this license had not been made. But such termination of the said license, or its termination by lapse of time, shall not be deemed to terminate or in any way to impair or affect any admissions hereinbefore made by the party of the second part of the validity and effects of the said letters patent, but all such admissions shall continue binding on, and not be controverted by, the party of the second part.

Sixth. That this license shall continue in force until the first day of January, 1873, unless revoked by the party of the first part on account of violations of its provisions by the party of the second part; but such revocation shall not release or discharge the party of the second part from his covenants, or from any amount due from him as license-fees.

For the true and faithful performance of every covenant herein contained, the said for himself, his heirs, executors, and administrators, and assigns, does bind each and every one of them unto the said party of the first part, and their successors and assigns, in the sum of one thousand dollars of lawful money of the United States, liquidated and agreed damages.

In witness whereof *of* the party of the second part has hereunto set his hand and seal; and the said Goodyear Dental Vulcanite Company, by their treasurer, Josiah Bacon, who is duly authorized in this behalf, have hereto set their hand and seal, this day of , 1872.

[SEAL.] GOODYEAR DENTAL VULCANITE COMPANY,

By *Treasurer.*

Licensee.

[5-cent revenue stamp.]

205 *Exhibit Josiah Bacon, No. 3.—J. G. S., Examiner.*

GOODYEAR DENTAL VULCANITE COMPANY.

License and agreement.

Whereas letters patent of the United States were lawfully granted unto John A. Cummings, of Boston, bearing date June 7, 1864, for an

"improvement in artificial gums and palates," of which improvement the said Cummings is the first and original inventor; and

Whereas said letters patent were lawfully surrendered on account of a defective and insufficient specification, and were, on the tenth of January, 1865, lawfully reissued to the Dental Vulcanite Company, a corporation duly established in Boston, Mass., who were the lawful assignees of the aforesaid patent and invention; and

Whereas said reissued letters patent were again lawfully surrendered on account of a defect in the specification, and were lawfully reissued on the twenty-first day of March, 1865, in due form of law, to said Dental Vulcanite Company; and

Whereas the Goodyear Vulcanite Company aforesaid are the legal owners by assignment of the said reissue and the exclusive right to make, use, and vend the invention of said Cummings aforesaid; and

Whereas of , county of , and State of , is desirous of acquiring the right, privilege, or license of using the invention of said John A. Cummings, and of working the said process and using the said invention for making artificial gums or plates for artificial teeth, according to the specifications of the letters patent above described, it being hereby expressly admitted, declared, and agreed by the said that the above-mentioned letters patent, under which the license hereinafter mentioned is granted and received, are valid and effectual in law to secure that exclusive right which they purport to secure:

Now, this agreement made between the Goodyear Dental Vulcanite Company aforesaid, of the first part, and the said of the second part, witnesseth:

The Goodyear Dental Vulcanite Company, for and in consideration of the sum of dollars and the faithful performance by the
206 party of the second part of the conditions herein specified, doth hereby grant to the party of the second part a right, privilege, or license, under the invention of said Cummings, and the patent for the same, to use the said invention, for the production of artificial gums, or plates for artificial teeth, in his own business as dentist, and for his own patients only, and for no other purpose, and to vend the gums and plates thus prepared to his own patients only, within the said of , and in such other place only as there may be no located licensee of the company, and not elsewhere during the time for which this license is granted, upon the following conditions:

First. That the said privilege or license shall not be assigned, sold, transferred, or otherwise disposed of in any manner.

Second. That the party of the second part shall not, by himself, his agents or servants, directly or indirectly, use or practice said invention, or vend said plates or gums for or to other dentists, nor in any way, except in his own business, and for his own patients.

Third. That the said party of the second part shall in no manner countenance or encourage infringements on the letters patent or invention above described, but shall at all times recognize the validity of said patent.

Fourth. That whenever said party of the second part shall furnish full and sufficient evidence, and produce the affidavits of witnesses, that any dentist in the city or town where the party of the second part resides is infringing said patent, then the party of the first part shall commence proceedings against such infringing party, if he can be disc vered, and prosecute the same in a reasonable manner, and by all reasonable and proper means.

Fifth. That the party of the second part shall not admit as a partner in his business as a dentist, directly or indirectly, any person or persons who stand enjoined from the use and practice of said invention by the decree of any competent court; nor shall anything in this license contained be any protection or defence to the person or persons so enjoined.

Sixth. That the party of the second part, for and in consideration of the rights and privileges herein granted, hereby covenants and agrees to hold the within-granted rights and privileges subject to the terms and conditions herein specified; and that in case of failure on his part to comply with all or any of them, or the failure to pay at maturity any note given for past infringements or future license fees, then this
207 license shall be terminable, at the election of the party of the first part, and upon a written or printed notice thereof, served upon the party of the second part, or published in a paper having circulation in the county where the party of the second part resides or is doing business. And, also, the party of the first part, if they so elect, may, in case of such breach and revocation of license, regard all the hard rubber work done done by the party of the second part, prior to such revocation, as done, and said party agrees that it may be deemed and taken as done, without license, and an infringement of said letters patent, and the party of the first part may proceed accordingly for injunction and account of profits, as if this license had not been made. But such termination of the said license, or its termination by lapse of time, shall not be deemed to terminate or in any way to impair or affect any admissions hereinbefore made by the party of the second part of the validity and effects of the said letters patent, but all such admissions shall continue binding on, and not be controverted by, the party of the second part.

Seventh. That this license shall continue in force until the first day of January, 1874, unless revoked by the party of the first part on account of violations of its provisions by the party of the second part; but such revocation shall not release or discharge the party of the second part from its covenants, or from any amount due from him as license-fees.

For the true and faithful performance of every covenant herein contained, the said for himself, his heirs, executors, and administrators and assigns, does bind each and every one of them unto the said party of the first part, and their successors and assigns, in the sum of one thousand dollars of lawful money of the United States, liquidated and agreed damages.

In witness whereof the party of the second part has hereunto set his hand and seal; and the said Goodyear Dental Vulcanite Company, by their treasurer, Josiah Bacon, who is duly authorized in this behalf, have hereto set their hand and seal, this day of , 1873.

[SEAL.] GOODYEAR DENTAL VULCANITE COMPANY,

By *Treasurer.*

Licensee.

208 *Complainants' Exhibit A.*

The U. S. Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this

office of the caveat of John A. Cummings, filed May 14th, 1852, for "improvement in the setting and in the plates of artificial teeth."

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this seventeenth day of April, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

To Hon. THOMAS EWBANK,
Commissioner of Patents:

The petition of John A. Cummings, of Boston, in the county of Suffolk, and State of Massachusetts, respectfully represents:

That your petitioner has invented certain new and useful improvements in the setting and plates of artificial sets of teeth, and that he is desirous of further time to prepare his specification, &c., and to make further experiments to mature his invention, previous to his applying for letters patent therefor. He therefore prays:

That the subjoined description of his invention may be filed as a caveat in the confidential archives of the Patent Office, and preserved in secrecy, and that due notice may be given him (through Ezra Lincoln, of Boston, his attorney) of any interfering application which may be filed during the space of one year from the date hereof, he having paid twenty dollars into the Treasury of the United States, and complied with all the requisitions of the patent acts in such cases made and provided:

JOHN A. CUMMINGS.

BOSTON, *May 11th*, 1852.

The following is the description referred to in the foregoing petition:

A serious objection has hitherto been experienced in fitting sets of artificial teeth, arising from the hard, unyielding nature of the
209 plate by which they were held in the mouth, as this plate not only hurt the mouth but impeded, in some degree, both mastication and perfect articulation. The expensive material also of which the plate has been composed has prevented many persons from availing themselves of the advantages of artificial teeth. My improvements, by which these objections are obviated, consist in forming the plate, and also the gums in which the teeth are inserted, of rubber or some other elastic substance, so compounded with sulphur, lead, and other similar substances as to form a "hard gum" or "whalebone gum," which is rigid enough for the purposes of mastication and pliable enough to yield a little to the mouth. By this improvement the teeth can be easily baked into the gums, which form one piece with the plate.

The plate, by its elastic and yielding properties, will adapt itself more readily and accurately to the inequalities of the mouth, and thereby be held firmly in the same, and at the same time yield a little to the motions of the mouth in mastication or articulation, thus effecting a desideratum which has long been considered of great importance.

Ex'd. L. F. S.—Caveat of John A. Cummings.

Complainants' Exhibit B[1].

The U. S. Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office of the drawing in the matter of the apdlication of J. A. Cummings, filed April 12th, 1855, for "dental plate."

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this fourteenth day of May, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

110 *Complainants' Exhibit E.*

The U. S. Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office of the file-wrapper and contents in the matter of the application of John A. Cummings, filed April 12th, 1855, for "forming artificial palates and gums," dentistry.

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this thirtieth day of April, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

2 drg. and model.

BOSTON, *April 10th*, 1855.

DEAR SIR: Herewith I send you the petition, specification, duplicate drawings, and Treasury rec't for supplementary fee of $10, constituting J. A. Cummings' application for a patent for improvements in artificial palates and gums and for inserting artificial teeth.

The specimen is also enclosed. Please file the case as usual, and oblige

Your ob't ser.,

EZRA LINCOLN.

Hon. CHARLES MASON,
Commissioner of Patents.

Applt. to office filed 12 April, '55. 3244,1.

To Hon. CHARLES MASON,
Commissioner of Patents:

The petition of John A. Cummings, of Boston, in the county of Suffolk and State of Massachusetts, respectfully represents—

That your petitioner has invented certain new and useful improvements in the method of forming artificial palates and gums, an exclusive property in which he is desirous of having secured to him and his legal representatives, by letters patent, according to law, he hav-
211 ing previously filed a caveat for the same, and paid twenty dollars into the Treasury of the United States, and having paid the

remaining fee of ten dollars, and complied with all the requisitions of the patent acts in such cases made and provided.

JOHN A. CUMMINGS.

BOSTON, *April 9th*, 1855.

To Hon. CHARLES MASON,
Commissioner of Patents:

SIR: I hereby recognize and appoint Ezra Lincoln, of Boston, as my agent and attorney to solicit and receive letters patent for my improved method of forming artificial palates and gums; also for withdrawing my application for the same, should it be found necessary, and in general to do all such things in the premises as he may deem to be for my advantage.

JOHN A. CUMMINGS.

BOSTON, *April 9th*, 1855.

John A. Cummings. Petition and power of att'y. Filed April 12, '55—3244.

To all persons to whom these presents shall come:

Be it known that I, John A. Cummings, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful improvements in the manner of forming artificial palates and gums, used for inserting artificial teeth, and that the following description, taken in connection with the accompanying drawings hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said invention, by which it may be distinguished from others of a similar class, together with such parts as I claim and desire to have secured to me by letters patent:

The figures of the accompanying plate of drawings represent my improvements. Fig. 1 is a front elevation of a set of artificial teeth and plate formed by my improved method. Fig. 2 is a view of the lower side of the plate and teeth. Fig. 3 is a central vertical section of the same.

The method hitherto practiced of attaching artificial teeth to a metallic plate fitting to the roof of the mouth is attended with many objections and inconveniences, as the plate, being hard and unyielding, naturally hurts the mouth, and in some degree impedes mastica-
212 tion and perfect articulation, while the expense of the metal employed prevents many from availing themselves of the advantages of artificial teeth.

The present invention consists in forming the plate and gums to which the teeth are attached of rubber or some other elastic material, so indurated as to be rigid enough for the purpose of mastication, and pliable enough to yield a little to the motions of the mouth, and in one piece, the teeth being imbedded in the elastic material while the said material is in a soft condition, and then baked with the gums and plate, so that the teeth, gums, and plate will all be connected, forming, as it were, one piece.

a a a, &c., in the drawings, represents the artificial teeth prepared in the usual manner.

The plate and gums *b b c c* are formed in one piece and of rubber, or of rubber and the compounds commonly employed therewith, or of gutta-percha, or in fact of any elastic substance which can be reduced to a soft condition, and then vulcanized or hardened sufficiently to answer the purposes. The rubber or the material is first moulded so as to fit the

shape of the mouth and gums formed, and, while soft and pliable, the teeth *a* are imbedded in the gums, and as an additional security fastened to the same by small pins *c' c'*, Fig. 3. The teeth, gums, and plate being thus connected, are then baked until the rubber or other elastic material becomes sufficiently vulcanized, when the process is completed, the plate being hard and rigid enough for the purposes of mastication, and yet, by its elastic nature, yielding to the motion of the mouth, while the teeth are firmly embedded and secured in the gums. The plate and gums can be colored in any proper manner to imitate nature.

Having thus described my improvements, I shall state my claim as follows:

What I claim as my invention, and desire to have secured to me by letters patent, is—

Forming the plate and gums in which the teeth are inserted in one piece of rubber (or other elastic material or materials), which can be hardened sufficiently for the purpose of mastication, and retain a portion of the elasticity, so as to yield a little to the motions of the mouth, as herein set forth, and for the purposes specified.

JOHN A. CUMMINGS.

Witnesses:
EZRA LINCOLN.
JOSEPH GAVETT.

213 STATE OF MASSACHUSETTS,
County of Suffolk, ss:

On this 30th day of April, in the year 1855, personally appeared before me the above-named John A. Cummings, and made oath that he verily believes himself to be the original and first inventor of the improvements herein above specified and described; that he does not know or believe the same were ever before known or used; and that he is a citizen of the United States of America.

[SEAL.] EZRA LINCOLN,
Notary Public.

This oath has been informally changed by the app't—contrary to the rules—3 August, 1855.

STATE OF MASSACHUSETTS,
County of Suffolk, ss:

On this 30th day of July, in the year 1855, personally appeared before me the above-named John A. Cummings, and made oath that he verily believes himself to be the original and first inventor of the improvements herein above specified and described; that he does not know or believe the same to have ever before been known or used; and that he is a citizen of the United States of America.

[SEAL.] EZRA LINCOLN,
Notary Public.

Rec'd and filed April 12, '55. S. T. Shugert. John A. Cummings, appl'n. 3244.

This certifies that I have worn a set of teeth constructed on the principal of Dr. J. A. Cummings, of Boston, on an India-rubber plate, for about three months, and find that it is better suited to the mouth for dental purposes than metallic plates. The elasticity and texture of the

India-rubber makes it more congenial to the mouth. Having worn several sets on metallic plates, and for the term of three years, I am able to speak understandingly and with confidence in regard to the value of India-rubber for dental substitutes.

F. A. BEVIN.

214 STATE OF CONNECTICUT,
New Haven County, City of New Haven, ss:

Personally appeared before me the above-mentioned F. A. Bevin, and made oath to the above statement.

LUCIUS ATWATER,
Justice of the Peace.

Signed in presence of—
EDWIN D. ATWATER.

3244, 2] 19 *May*, 1855.

The specification and claim of your application for l. p. for forming artificial palates and gums have been examined. You are referred to the article "Gutta-percha as a base of artificial teeth," in the American Journal of Dental Science, vol. ii, series 2, page 332, and to Delabarre's artificial palates and gums, described in Dingler's Polytechnic Journal, vol. 122, page 239, wherein you will find your device anticipated.

Your claim is therefore rejected.

TYSSONSKI,
For L. D. Gale.

JOHN A. CUMMINGS, Esq.,
(Care of Ezra Lincoln,)
Boston, Mass.

Office to applicant, I; rejection 19. May, '55. 3244, 2.

BOSTON, *July 30th*, 1855.

DEAR SIR: With this I return you the specification of John A. Cummings' impr'v'ts in sets of artificial teeth. After examining the references in the letter from the office of May 19th more carefully, Mr. Cummings has amended his specification and taken the oath of invention, and having stricken out all reference to gutta-percha. In the originating this invention Mr. Cummings supposed that he was first in the use of mineral teeth, &c., with a gum which becomes plastic by heat and hardens by cooling; but he had always intended to use the vulcanized rubber as the best material, and only put in gutta-percha for the sake of extending his protection. The vulcanized rubber, as he writes in his amendment to his specification, has many properties which peculiarly adapt it to this use, and which, being absent in gutta-percha, he now finds would render it unfit for such a use.

I beg the office not to consider that, because gutta-percha has been used before with artificial teeth, *that* Mr. Cummings' invention is
215 therefore the mere substitution of one substance for another and a similar one; for such is not the case.

The vulcanizing process makes all the difference, requiring invention and experiment, and changes the article of manufacture entirely, making the palate elastic, which gutta-percha would not, and rendering the whole article (so far as gums and palates are concerned) capable of resisting heat and acids, which gutta-percha will not.

There is a similar case which was granted last year, and which is perfectly parallel to the case now presented.

A patent was granted to J. M. Batchelder, June 13, 1854, for covering telegraphic wires with India-rubber, &c., for insulating them, &c., when wires had been before covered with gutta-percha for the same purpose. With these views, and the suggestions contained in the amendments to the spec'n now sent, I ask for a revision of the decision. I send herewith a more perfect specimen of a set of teeth, although the materials are precisely similar to those of the sample at the office. I also send a certificate of a gentleman who has used a set for some time.

Very resp., your ob. ser.,

EZRA LINCOLN.

Hon. S. T. SHUGERT,
Act'g Commiss. of Patents.

J. A. Cummings to office. Filed 3d August, '55. 3244, 3.

To Hon. S. T. SHUGERT,
Acting Commissioner of Patents.

SIR: I hereby amend my specification, by striking out the words "or some other elastic material," on the 27th and 28th lines of page 1, and substituting the word "vulcanized" for the word "indurated;" in the 28th line of the same page; also by striking out the words "or of gutta-percha, or in fact of any elastic substance," in the 7th and 8th lines of the second page, and the words "or other elastic material," on the 16th and 17th lines of page 2nd; also by inserting at the close of the specification the following words, viz: "I am aware that gutta-percha has been used for artificial palates, but has been found to be totally inadequate to the purpose, as it becomes plastic when submitted to water below the boiling temperature, and cannot, therefore withstand the heat of the liquids which ordinarily are passed through the mouth; neither can it resist the action of the acids which come from the
216 secretions about the same, and consequently its application to this purpose has long been abandoned as impracticable. My improvements in the manufacture of sets of artificial teeth, it will be observed, consists in combining them with rubber, &c., which is vulcanized after the teeth are inserted therein. The vulcanized rubber may be made nearly as hard as bone and yet retain some of its elasticity, and after being properly vulcanized it is unaffected by exposure to the air, to water, to organic acids, and uninfluenced by any ordinary agents. It therefore possesses all the qualities which are desirable in artificial palates, which, as I have before stated, gutta-percha does not."

I also further amend my specification, by striking out the claim and inserting in lieu thereof the following:

"I do not claim the use of gutta-percha, or of any material which is merely rendered plastic by heat and hardened by cooling, in the manufacture of sets of artificial teeth; but what I do claim as my invention, and desire to have secured to me by letters patent, is the improvement in the manufacture of sets of mineral or other artificial teeth, which consists in combining them with a rubber palate and gums, which (after the insertion of teeth) are vulcanized by Goodyear's process, or any other process, forming thereby a cheap, durable, and elastic substitute for the gold plates, &c., heretofore used."

JOHN A. CUMMINGS,
By his att'y EZRA LINCOLN.

BOSTON, *July* 30, 1855.

To Hon. CHAS. MASON,
Commis. of Patents.

SIR: I hereby amend my amendment to the specification of my improvements in gas-burners by substituting the word "plate" for palate, wherever the same occurs in the said amendment.

JOHN A. CUMMINGS,
By his att'y, EZRA LINCOLN.

BOSTON, *Jan. 17th*, 1856.

Amendments filed 3 August, 1855. 3244.

4th. 3244, 4.

AUGUST, 1855.

Yours of the 30th ult., with enclosures in the case of your appl'n for l. p. for artificial dental palates and gums, is received, and your
217 case will be considered as soon as you comply with the rule with regard to the renewal of your oath, without infringement upon the other rule that no erasure is ever permissible in any paper on file in this office.

The date of your oath being erased and another substituted is no evidence of the renewal.

Your specification is returned to enable you to renew the oath in proper form.

L. D. GALE,
By TYSSONSKI.

JOHN A. CUMMINGS,
(Care of Ezra Lincoln.)
Boston, Mass.

Office to John A. Cummings, 4 August, 1855. 3244, 4.

BOSTON, *August 8th*, 1855.

DEAR SIR: With this I return the specification of Dr. John A Cummings, having amended the same by appending the new oath. I should not have made the erasure in the original oath had I not supposed that such things were permitted, thinking the oath was considered a matter independent of the spec'n.

Very resp., your ob. ser.,

EZRA LINCOLN.

Hon. S. T. SHUGERT,
Act'g Commiss. of Patents.

J. A. Cummings to office. Filed 9 August, 1855. 3244, 5.

14th. 3244, 6.

AUGUST, 1855.

Your amended specification and claim of your appl'n for l. p. for artificial palates has been re-examined, in connection with your argument filed the 30th ult. If the points made out by you against the use of gutta-percha for artificial palates are correct, then the subject of your application is different from the original application, and your remedy is not an amendment of the rejected application, but a withdrawal thereof, and a filing of a new application. If your statement is erroneous, then the rejection of May 19, 1855, holds good, even for your claim restricted.

218 There appears, consequently, no necessity to enter now in an examination of your alleged invention as restricted by your amendment. Lest by this letter you should, however, not consider yourself invited to file a new application, your attention is called to the article caoutchouc, page 105, in Harris' Dictionary of Dental Science, where you will find India rubber quoted as a material for analogous purposes with yours. Furthermore the India rubber you employ must be treated, unless you are able to show otherwise, by one of the known vulcanizing processes, and particularly by that patented by Nelson Goodyear, May 6, 1851. The patent of the latter covers, however, all the forms to which this material might be employed, so that to use it for palates would appear as an infringement of his right.

Your additional model, being made of gutta-percha, is unfit to illustrate your invention as recently claimed. As to J. M. Batchelder's patent, the office had particular reasons to grant it, bearing no *no* analogy to your case; and if the decision was erroneous, such error would not impose upon the office an obligation to reiterate the same.

Under the circumstances the decision of May 19th 1855, is adhered to.

TYSSONSKI,
For L. D. Gale.

JOHN A. CUMMINGS,
(Care of Ezra Lincoln,)
Boston, Mass.

Office to E. Lincoln. II rejection, 14 August, 1855. 324, 6.

Will Mr. Shugert please give this letter his personal attention, and oblige his ob't ser.,

E. LINCOLN.

BOSTON, *September 10th*, 1855.

DEAR SIR: I wish to call the personal attention of yourself to the letter from the office, under date of August 14th, having relation to the application of Dr. Cummings for a patent for an improved mode of manufacturing sets of artificial teeth. The letter was written after a second examination of the case, and a second and better model was furnished, substantially the same as the former. I do not desire to call attention to or to discuss the general views of the letter, but only ask the
219 Commissioner to read a sentence near the close, which is an imputation upon the integrity of my client and upon that of myself, and which is in these words: "Your additional model, being made of gutta-percha, is unfit to illustrate your invention as recently claimed." The allegation made by my client and myself was that the parts stated by the examiner to be made of "gutta-percha" were made of vulcanized India rubber.

Without the slightest hesitation or qualification, the examiner charges deliberately a joint design to deceive the office.

In a connection of some 16 years with the office, I have never before had the slightest intimation of a particle of unfairness in any of my dealings, and if this change were true, and I was cognizant of the intended fraud, I should hold myself entirely unfitted to hold any further correspondence with your department on any subject. Dr. Cummings and myself have been unable to have an interview upon this subject until within a day or two, owing to his and my own absence from the city. I directed him immediately to substantiate his allegation by proper affi-

davits, which are herewith enclosed, and which I think will be amply sufficient, without comment, to induce the examiner to retract the obnoxious charge which I know you will deem a proper self-respect on my part must induce me to insist upon.

Dr. Cummings is a gentleman whose character in his profession is of the highest class, and he desires me to say that he feels greatly aggrieved by this attempt to call his honesty in question.

This is the first time in my intercourse with the department that I have had occasion to charge a lack of courtesy upon the part of the examiner, and I make this communication to yourself, with entire confidence and trust that the wrong which I feel has been done both to me and my client will be promply repaired.

Waiting your reply in the premises, and

I am, very truly, yours,

EZRA LINCOLN.

Hon. S. T. SHUGERT,
Act. Commiss. of Patents.

John A. Cummings to office. Filed 18 Sept'r. 3244, 7.

To whom it may concern:

This may certify that I, F. A. Bevin, of the city of New Haven, Connecticut, was employed by Dr. John A. Cummings, of Boston,
220 doctor of medicine, dentist by profession, to make samples of India-rubber plates for teeth; that I have made sundry specimens and forwarded them by express to said Cummings; that no particle of gutta-percha was used in the material of which the same were composed; that I have been engaged in the manufacture of vulcanized rubber goods, samples and fabrics for seven years; that said samples were made by myself, and that from my own knowledge I declare that no part of either of the samples was gutta-percha; that they were vulcanized rubber, and are what are known to manufacture as hard gum and whalebone gum.

F. A. BEVIN.

Personally appeared before me the above-mentioned F. A. Bevin, and made oath to the above statement.

New Haven, New Haven County, C't, Aug. 30, 1855.

LUCIUS ATWATER,
Justice of the Peace.

Witness:
E. D. ATWATER.

SEPT. 18, 1855.

Yours of the 10th ult., in relation to your rejected appl'n for pat. for artificial palates, is received.

The sentence alluded to by you in the official letter of the 15th ult. originated in the following:

Your first specimen appeared to be made of gutta-percha. In your letter of April 10, 1855, you do not state of what it was made; in your specifications you describe, as one of the materials used by you, gutta-percha.

At the time of the first rejection, therefore, the office considered your specimen to be made of gutta-percha.

In your argument of July 30th, 1855, you do not say that no gutta-percha entered in the manufacture of your specimen, but at the close of your letter you say, "I send herewith a more perfect specimen of a set

of teeth, although the materials are precisely similar to those of the sample at the office." Under the impression which, as above stated, the office had at the time, nothing else could be inferred from the quoted words than what was really inferred, that from want of ready
221 specimens made of India rubber, you sent one of gutta-percha, yet without deceit or unfairly, but avowedly, and stating the fact in your letter.

This having been the impression of the office, and as it appears an impression justified by your own words, you will, it is hoped, see in the sentence complained of neither an imputation against you nor a trespass upon courtesy, but simply a remark with reference to the presumed informality of the specimen filed by you.

In this connection it is added that a simple statement of yours would have been considered fully equal to the evidence furnished by the affidavits you enclosed. No obnoxious charge having been intended by the office, this explanation will, it is hoped, be found satisfactory.

JOHN A. CUMMINGS
(Care of Ezra Lincoln),
Boston, Mass.

This letter written by Tyssonski, assistant to Dr. Gale. Office to J. A. Cummings, 18 Sept., 1855. 3244, 8.

BOSTON, *September 28th*, 1855.

DEAR SIR: Will you please send me the specification of Dr. John A. Cummings' artificial teeth, and oblige,
Your obt. ser.,

EZRA LINCOLN.

Hon. S. T. SHUGERT,
Acting Commiss. of Patents.

J. A. Cummings to office. Filed 2 Oct'r, '55. 3244, 9.

3244, 10.] OCTOBER, 1855.

Agreeable to yours of the 28th ult., you will find enclosed your specification for artificial palates and gums.

Dr. JOHN A. CUMMINGS
(Care of Ezra Lincoln),
Boston, Mass.

Office to J. A. Cummings, 2 Oct., '55. 3244, 10.

BOSTON, *Jan'y 17th*, 1856.

DEAR SIR: Herewith return the specification of John A. Cummings' impr'v'ts in the manufacture of sets of artificial teeth, having made
222 a slight verbal amendment, the error in which occurred in copying. I am requested by the applicant in this case to make an appeal to the Commissioner, and would, therefore, request that all the papers may be laid before him.

When the case was prepared, the supposition was that the forming the plates and gums of any plastic substance in which, while plastic, the teeth could be inserted and there held by the hardening of the same, was new.

The original specification, it will be seen, identified the impr'v't suggested in the amended claim, viz, the impr'v'ts in the manufacture of sets of artificial teeth, and notwithstanding the prior use of gutta-percha

in this manufacture, I think will be admitted, on reading the disclaimer and amended claim, that there is a patentable distinction.

The gutta-percha has been abandoned because it would not withstand the warmth of the secretions and the acids about the mouth. The combination of the mineral or other teeth with India rubber (to be vulcanized after the teeth are inserted) makes a new article of manufacture which is practicably useful, and can be afforded at a much cheaper rate than any sets of artificial teeth which can be used successfully.

The question whether there is anything patentable in this case can be determined under this application, and the preamble could be altered to suit the amended claim.

Hoping for a favorable issue in the case, I remain,

Very truly, y'rs,

E. LINCOLN.

Hon. CHAS. MASON,
Commiss. of Patents.

Ezra Lincoln asks a reconsideration of John A. Cummings' case.

A. S. W. J.

Recd. January 19, 1856.

BOSTON, *January 20th*, 1856.

DEAR SIR: Herewith I send a drawing in the case of Dr. John A. Cummings' impr'v'ts in the manufacture of sets of artificial teeth, inadvertently left out of the package when his papers were last transmitted to the office.

Very resp., your obt. ser.,

EZRA LINCOLN.

Hon. CHAS. MASON,
Commissioner of Patents.

Recd. Jan. 29, 1856. J. A. Cummings.

223 6th. U. S. PATENT OFFICE, *Feb'y 5th*, 1856.

SIR: In the matter of appeal by John A. Cummings from the decisions of the examiner, I beg leave to present the following report:

Dr. John A. Cummings' original claim to artificial palates and gums used for inserting artificial teeth by forming the gum-plate and gums in which the teeth are inserted in one piece of rubber or other elastic material or materials, which can be hardened sufficiently for the purpose of mastication, covered, in fact, any elastic substance, gutta-percha being named as one of them.

These substances, with compounds of others commonly employed to harden them, were, after the teeth composed of porcelain or the ordinary earthy materials had been attached, and the gums and palate moulded into shape, submitted to heat and "vulcanized" by baking.

On the first rejection, May 19, 1855, reference was made to gutta-percha's having been used for the same purpose, and the reference was admitted to be correct. Gutta-percha is very generally, and properly, I believe, considered an equivalent of caoutchouc or India rubber, of which there are many varieties.

The propriety of the reference to the previous use of gutta-percha having been admitted, the specification and claim was so amended as to attach particular importance to vulcanized India rubber. This was then met by reference to Harris' Dictionary of Dental Surgery, where

(p. 105), under the head "caoutchouc," it is stated Mr. Stearns, a surgeon of London, has employed this material prepared by Goodyear's process, or "vulcanized," for artificial palates, &c. Nelson Goodyear's patent of May 6th, 1851, foreclosed the claim for vulcanizing or hardening the materials used, and their use, when vulcanized, having been shown by the references to be old, it does not appear to me that there is room left for a patentable claim.

The argument in appeal, that the combination of the mineral or other teeth with India rubber, to be vulcanized after the teeth are inserted, makes a new article of manufacture, which is practically useful, and can be afforded at a cheaper rate, is not to the point.

If the article is not new, as shown by the references, and the mode of manufacture is not new, also shown by reference to Goodyear's pat's, then the remaining argument—affording the articles manufactured at a cheaper rate—avails nothing, as no price was set forth or explained, neither could it under existing practice form a part of the specification under examination.

224 In vulcanized articles made of caoutchouc, according to Goodyear's patent above noticed, and others, I believe it is commonly the practice, after compounding the rubber with sulphur and other materials, to mould it to the shape required, inserting all requisite appendages, such as the hinges of a box, wood to be veneered, a gun-barrel to be covered, or the parts of a penknife which is to have a composition handle, all before the article is placed in the oven to be vulcanized, thus removing all claim to novelty of the invention under consideration. And it is accordingly suggested that the patent be finally refused.

Respectfully submitted.

T. R. PEALE, *Exr.*

To the Hon. CHAS. MASON,
Commissioner of Patents.

Approved.

C. MASON.

U. S. PATENT OFFICE, 6 *Feb.*, '56.

SIR: You are hereby informed that your application for devices in making artificial gums and palates, twice rejected by the examiner, has been referred to a board for revision of the previous actions; which actions, for reasons on file, have been sustained and are now affirmed.

Respectfully,

DR. GALE.

JOHN A. CUMMINGS
(Care of Ezra Lincoln, esq.), *Boston.*

Office to J. A. Cummings. III rejection, Feb'y, '56. 3244, 2.

BOSTON, *Jan'y* 17, 1859.

DEAR SIR: Will you please send me the specification and one drawing of John A. Cummings' application for a patent for improvements in artificial palates for teeth, and much oblige,

Your ob. ser.,

EZRA LINCOLN.

Hon. J. HOLT,
Commiss. of Patents.

John A. Cummings, rej'd 3d time, 6 Feb, '56. Filed 12 April, '55; rec'd and filed Jan. 19, '59. H. W.

225 U. S. P. O., *Jan. 20th*, '59.

SIR: In reply to your letter of Jan'y 17th, you are informed that your case having been acted upon finally by the Commissioner, the papers belong to the office, and the only one which can be returned to you is the thin drawing, which is accordingly herewith enclosed.

Respectfully,

WURTZ.

JOHN A. CUMMINGS
(Care of Ezra Lincoln), *Boston, Mass.*

Office *of* to Cummings, Jan. 20, '59.

No. 3244. John A. Cummings, of Boston, county of Suffolk, State of Mass. Forming artificial palates and gums. Dentistry.

Oath renewed.

Recd.,	April 12,	1855.
Petition,	"	"
Affidavit,	"	"
Specification,	"	"
2 drawings,	"	"
Model,	"	"
1 cert. dep., $10,	"	"
Caveat,	May 14,	1852.

2 examined.
Issue.
3 patented, , 185 .
Recorded vol. , page .

EZRA LINCOLN, *Boston.*

Rejected, 19 May, 1855.
Papers to me June 7th, 1855.

EZRA LINCOLN.

3, 4, spec'n ret'd to app't 4 August, 1855.
5, 6, rejected II, 14 " "
7, 8, letter, 18 Sept'r, "
9, 10, spc. to app't, 2 " "
" " office, Jan'y, '56.
12, rej'd III, by board *by* ex'r 6th Feb., '56.
13, 14, thin dr. ret. to agt., 20 Jan., '59.
Ex'd, L. F. S.

226 United States circuit court, district of Maine. In equity.

GOODYEAR DENTAL VULCANITE COMPANY
vs.
DAVID B. STROUT.

SAME
vs.
CHARLES E. HUSSEY.

SAME
vs.
JEREMIAH MASON.

SAME
vs.
GEORGE F. TOWLE.

SAME
vs.
NATHAN WOODBURY ET AL.

SAME
vs.
CHARLES F. WARD.

Evidence for complainants in reply.

Testimony taken on behalf of complainants, in rebuttal, for a final hearing under Rule 67 of the Supreme Court in equity, as amended, before John A. Shields, special examiner.

NEW YORK, *August* 25, 1876—12 m.

Present, Edward N. Dickerson and B. F. Lee, esqs., of counsel for complainants, and Henry Baldwin, jr., and E. Luther Hamilton, esqs., of counsel for defendants.

Counsel for complainants offer in evidence the printed depositions in the case of the Goodyear Dental Vulcanite Company vs. Daniel H. Smith, in the circuit court of the United States for the district of Massachusetts, pursuant to stipulations made herein. (See pages 133 to 207.)

1. The deposition of George H. P. Flagg.
2. The deposition of Albert G. Wilber.
3. The deposition of David Thayer.

227 4. The deposition of Frances M. Cummings.

5. The deposition of Josiah Bacon.
6. The deposition of Anthony Pollock; and the exhibits therein referred to.
7. The deposition of Edward C. Rushmore.
8. The deposition of Alfred Randall.

EBENEZER ROBY, a witness called on behalf of complainants, being duly sworn, testifies as follows:

Question 1. What is your name, age, residence, and occupation?

Answer. My name is Ebenezer Roby; I am forty-six years old; I reside at Brooklyn, N. Y.; I am engaged in the India-rubber business.

Ques. 2. How long have you been engaged in that business?

Ans. Since 1846.

Ques. 3. Are you familiar with caoutchouc or pure India-rubber; and, if yea, will you produce a specimen as an exhibit in this cause?

Ans. I am; I produce a specimen.

(Specimen produced, and marked Exhibit Roby caoutchouc, J. A. S., Exr.)

Ques. 4. Are you familiar with vulcanized soft rubber made by the Charles Goodyear process; and, if yea, will you please produce a specimen as an exhibit in this cause?

Ans. I am; I produce a specimen.

(Specimen produced, and marked Exhibit Roby vulcanized soft rubber, J. A. S., Exr.)

Ques. 5. Are you familiar with vulcanite or hard rubber, made by the

Nelson Goodyear process; if yea, will you produce a specimen as an exhibit in this cause?

Ans. I am; I produce a specimen.

(Specimen produced, marked Exhibit Roby vulcanite, J. A. S., Exr.)

Ques. 6. Are you familiar with pure gutta-percha; if yea, will you produce a specimen as an exhibit in this cause?

Ans. I am; I produce a specimen.

(Specimen produced, and marked Exhibit Roby gutta-percha, J. A. S., Exr.)

Ques. 7. Is pure gutta-percha an elastic substance in the sense in which vulcanite is elastic?

228 (Objected to as immaterial.)

Ans. It is not.

Ques. 8. Have you ever, in manufacturing India-rubber, had occasion to use sheets of pure tin? and, if yea, state whether you are familiar with its appearance and qualities; and produce a specimen if you can.

Ans. I have; and am familiar with its appearance and qualities; I produce a specimen.

(Specimen produced, and marked Exhibit Roby pure tin, J. A. S., Exr.)

Cross-examined by Mr. BALDWIN:

Cross-ques. 9. What branches of the India-rubber business have you been engaged in since 1846.

Ans. Soft rubber goods for mechanical purposes principally.

Cross-ques. 10. Have you manufactured such goods, or only dealt in them?

Ans. I have done both.

Cross-ques. 11. Have you manufactured hard rubber goods also?

Ans. I have not.

Cross-ques. 12. In manufacturing your rubber goods have you used the Charles Goodyear process?

Ans. I have.

Cross-ques. 13. Rubber goods made by that process are distinguished from hard rubber goods by what term?

Ans. The goods made under the Charles Goodyear patent are called soft vulcanized rubber goods in distinction from hard rubber goods.

Cross-ques. 14. Isn't the difference between these two classes of rubber goods due to the difference between the proportions of sulphur used in the compound, it being less in soft and greater in the hard rubber compound?

Ans. That is the principal difference.

Cross ques. 15. Except the difference in the proportions of sulphur in the vulcanizable compound, are hard rubber goods and soft rubber goods made in the same way?

Ans. I so understand that they are, but I have no practical knowledge of the manufacture of hard rubber goods.

Cross-ques. 16. Do you know the date of Charles Goodyear's patent, according to which you have made the soft vulcanized goods as you have stated?

229 Ans. Yes; in the year 1844.

Cross-ques. 17. In making soft vulcanized goods, have you used moulds to shape or to maintain the shape of different articles?

Ans. I have.

Cross-ques. 18. What kind of moulds have you used in this way?

Ans. Nearly all metal moulds; occasionally plaster.

Cross-ques. 19. Did you ever vulcanize the Charles Goodyear compound in a plaster mould that was closed tight?

Ans. I have.

Cross-ques. 20. In dry heat?

Ans. I could not say whether it was dry heat or steam heat. Since the use of steam heat in vulcanizing was invented, dry heat has not been used by me; and I think that was twenty-four years ago.

Cross-ques. 21. Then you have not vulcanized your soft-rubber goods in an oven where you used moulds, have you?

Ans. No; I have not.

Cross-ques. 22. In your manufacture of soft vulcanized goods, have you made any articles in which the rubber was attached to metal?

Ans. I have; principally valves, in which, in some cases, a metal ball was enclosed in a rubber one.

Cross-ques. 23. Haven't you known ever since you worked at rubber goods, and hasn't it been generally known that the rubber compound vulcanized by the Charles Goodyear process was elastic after vulcanization?

Ans. I have, and it has so been known.

Cross-ques. 24. Hasn't it been, during all this time, equally a matter of common knowledge that soft-rubber compounds, such as you have used, were, when vulcanized, tenacious as well as elastic?

Ans. It has.

Cross-ques. 25. Hasn't it been equally a matter of common knowledge all this time that such rubber compounds, when moulded and vulcanized upon other substances, such as metal, cling to them, and adhere closely at all points of contact?

Ans. No, sir; it has not.

Cross-ques. 26. Do you know whether this is or is not the case?

Ans. I have often found great difficulty in making vulcanized rubber adhere firmly to metal.

230 Cross-ques. 27. Do you mean when you moulded it on to the metal or around it, in the soft state, and vulcanized it in the mould?

Ans. I do.

Cross-ques. 28. Is it your experience that the vulcanizable compound does not naturally adhere closely to metal under the conditions mentioned in the last question: that is, when moulded upon or around it, and vulcanized in the moulds?

Ans. My experience is, that if the metal is made very rough, that the rubber would adhere in nearly all cases, but not what I would call very firmly.

Cross-ques. 29. The specimen, Exhibit Roby caoutchouc, is designated in question 3 as pure India rubber; hasn't it been cleansed of foreign substances and dirt, or is the exhibit in the condition in which it comes from the tree?

Ans. The exhibit is a remarkably fine specimen of crude rubber, just as imported, but we clean it before we use it, and get about fifteen per cent. of foreign matter out of it. This exhibit is from a lot that we bought the other day.

Cross-ques. 30. You say that Exhibit Roby vulcanized soft rubber is a specimen of vulcanized soft rubber made by the Charles Goodyear process; can that rubber be made harder by being again subjected to the vulcanizing process?

Ans. It would be a little harder, but it would be burned and rotten.

Cross-ques. 31. It couldn't be made hard rubber?

Ans. I know of no way in which it can be made into hard rubber.

Cross-ques. 32. Do you know how this Exhibit Roby vulcanite was made, or when, or where?

Ans. I do not.

Cross-ques. 33. Do you know, and, if yea, how do you know, that it is vulcanite?

Ans. I only know from my general observation and the appearance of hard-rubber goods.

Cross-ques. 34. What is there in this exhibit that shows, to your mind, that it is hard rubber or vulcanite?

Ans. I have cut into the exhibit, and find it to be in strength, color, and appearance the same as hard-rubber goods, which I have sold for years.

Cross-ques. 35. Can you see in this exhibit evidence satisfactory to yourself, that it is made of a compound of rubber and sulphur, in
231 the proportions required for making hard rubber or vulcanite, as distinguished from soft vulcanized products, and that it has been vulcanized?

Ans. I can.

Cross-ques. 36. Can you tell whether or not it was vulcanized in a mould, or moulds?

Ans. I cannot. I don't know how that article is made. I deal in hard rubber goods, but I do not know how they are manufactured.

Cross-ques. 37. Have you manufactured soft vulcanized goods in which gutta-percha was used in place of or in connection with caoutchouc or India-rubber?

Ans. I have not.

Cross-ques. 38. In Exhibit Roby gutta-percha are there any foreign matters or impurities that should be removed before it was used for manufacturing into goods?

Ans. I do not know.

Cross-ques. 39. Don't you know that pure gutta-percha is whiter than this exhibit, assuming that pure means simply clean or cleansed?

Ans. No, I don't know it.

Cross-ques. 40. Can you tell whether this Exhibit gutta-percha does contain any foreign matter or dirt?

Ans. I cannot tell; I don't believe that gutta-percha could be cleansed so as to get all the foreign matter out of it.

Cross-ques. 41. Do you deal in gutta-percha?

Ans. I do not.

Cross-ques. 42. Do you know where this Exhibit Roby gutta-percha came from?

Ans. I do not.

Cross-ques. 43. Do you know what it is prepared in this form for, or what uses are made of such gutta-percha as this exhibit?

Ans. I am told and believe that its principal use is to make or line vessels for containing acids; principally for photographic purposes.

Cross-ques. 44. Do you know to what treatment it is subjected in being applied to such use?

Ans. I do not know.

Cross-ques. 45. In what sense is vulcanite elastic?

Ans. Vulcanite is elastic in that it can be bent and it will return to its original form.

Cross-ques. 46. By vulcanite you mean hard rubber, do you not?

Ans. I do.

232 Cross-ques. 47. Is not that quality of vulcanite, more properly speaking, flexibility or resiliency?

Ans. It is.

Cross-ques. 48. Can you stretch vulcanite, and if you do, will it shorten up again like Exhibit Roby vulcanized soft rubber?

Ans. My knowledge is too limited to tell you anything on the subject.

Cross-ques. 49. You say Exhibit Roby pure tin is such as you had occasion to use in manufacturing India rubber; how have you used such tin in such manufacture?

Ans. We manufacture very largely rubber belting, in which the surface is made smooth by being brought in contact with sheet tin.

Subscribed and sworn before me this 25th day of August, 1876.

EBENEZER ROBY.

Complainants' counsel offers in evidence caveat of John A. Cummings, filed May 14, 1852, for improvement in the setting, and in the plates of artificial teeth, the same being printed in the case against Daniel H. Smith, hereinbefore referred to, and in evidence in the said suit, as Complainants' Exhibit A.

Also file wrapper and contents in the matter of the application of John A. Cummings, filed April 12, 1855, for forming artificial palates and gums, also contained in said Smith case as Complainants' Exhibit B; together with the drawing filed with said application, in evidence in said Smith record as Complainants' Exhibit B.

Also a certificate of the Patent Office in relation to the loss of the model filed with said application; and the same is marked Complainants' Exhibit N, J. A. S., Ex'r.

Deposition of Henry B. Renwick.

HENRY B. RENWICK, a witness called on behalf of complainants, being duly sworn, testifies as follows:

Question 1. Please look upon question 3 and the answer thereto of your deposition in the case of the Goodyear Dental Vulcanite Company and Josiah Bacon vs. Adolphe P. Preterre, in evidence in this cause, and state whether you have anything to add to, or desire in any respect to modify your answer to said question.

Ans. I have nothing to add to it, and do not desire to modify it.

233 (The said question and answer No. 3 in the Preterre case are considered as if now repeated and taken at this stage of their cause; and the depositions annexed to his cross-examination in his previous examination in these causes are considered to stand with the same effect as if taken in the proper order of proof in these causes, including his cross-examination as to the subject matter involved in said answer to question 3.)

Cross-examined by HENRY BALDWIN, Jr., Esq.:

Cross-ques. 2. Did you not make an affidavit on behalf of the complainants in the case of the Goodyear Dental Vulcanite Company et al. vs. Eben M. Flagg in the United States circuit court for the southern district of New York, and subscribed and sworn to the same before Francis A. Daniels July 18, 1875?

Ans. Yes.

Cross-ques. 3. Look at the certified copy now shown you, and say if you recognize it as a copy of such affidavit.

Ans. I have not compared it, having had no opportunity to do so, but I have no doubt but it is.

(Said copy put in evidence and marked Defendant's Exhibit, Flagg suit, J. A. S., ex'r.)

Cross-ques. 4. Look at Exhibit Roby gutta-percha, and say if you see any difference in that gutta-percha and the piece referred to under that designation in your deposition in the Preterre case?

Ans. I have not the piece referred to in the Preterre case before me. As far as I can remember there is no difference in quality between the two pieces, but whether they are of the same size and thickness I cannot state.

Cross-ques. 5. Is this Exhibit Roby gutta-percha crude gutta-percha or pure gutta-percha?

Ans. It is not crude gutta-percha, and is evidently the ordinary purified gutta-percha of commerce. Whether it is perfectly pure or not I cannot say—probably not.

HENRY B. RENWICK.

Subscribed and sworn to before me this 25th day of August, 1876.

234 *Defendant's Exhibit, Flagg suit.—J. A. S., ex'r.*

United States circuit court, southern district of New York.

THE GOODYEAR DENTAL VULCANITE COMPANY et al.
vs.
EBEN M. FLAGG.

DISTRICT OF RHODE ISLAND, *ss:*

HENRY B. RENWICK, being duly sworn, says:

My name is Henry B. Renwick. I am fifty-seven years of age. I reside in the city of New York. My principal occupation is the examination of machinery and processes in the arts, and I am frequently called as expert in the circuit courts of the United States, in various circuits, in suits in which patents are in question.

In December, 1873, I was examined as expert on behalf of complainants in suit of these complainants vs. Daniel H. Smith, brought on the Cummings patent, Reissue No. 1904, then pending in the district of Massachusetts, and I then had occasion to thoroughly acquaint myself with the state of the art of constructing sets of artificial teeth as it existed at the date of the invention covered by that patent as disclosed by the proofs in that case. Laying out of view the attempts to cast whole under-sets of pure tin by George E. Hawes and William A. Royce, and the attempts made to use unvulcanized gutta-percha, which, as I understand, were unsuccessful and impracticable, the only sets of teeth in practically successful use were made by striking up thin sheets of gold, silver, or platinum, between a die and counter die, and then soldering the teeth to the plate by means of small platinum pins attached to the teeth.

The die and counter die were formed by taking a wax or plaster impression of that part of the mouth proposed to be fitted by the finished plate, from that impression a plaster cast was taken which was an exact model of the mouth. From this model a mould in sand was made, into which was cast a hard metal—zinc being generally used for the purpose. This formed the die, which was thus a reproduction of the
235 plaster model. A counter die of lead was then cast fitting the

face of the zinc die. The sheet of metal was then stamped into shape between the die and counter die. The high temperature which platinum will bear without melting enabled the dentist to apply to sets of teeth, when mounted on a platinum base, a sort of porcelain paste which was applied to the teeth and metal plate, and afterwards baked into porcelain, the gums being formed of this paste, which was converted into porcelain by the baking. These were known as continuous gum sets of teeth. As I understand, however, owing to the great expense of such sets of teeth and their great weight, but few of them were used. I have frequently read and examined the reissued letters patent, No. 1904, granted to the Dental Vulcanite Company, as assignee of John A. Cummings, dated March 21st, 1865, an' I thoroughly understand the same, and the invention described therein. The invention, as claimed, may be described as a new article of manufacture, consisting of a plate of hard rubber, or vulcanite, or its equivalent for holding artificial teeth, with teeth, or teeth and gums secured thereto in the manner described in the patent, the whole making what is sometimes called a case, or, in ordinary language, a set of artificial teeth. (The manner described in the patent of securing the teeth to the plate is by imbedding the teeth and pins in the plate, while the substance of which it is composed is in a soft or plastic condition, so that when the material composing the plate becomes hard the teeth are firmly secured by being embedded with their pins in the substance composing the plate, so that there is a tight joint between the plate and the teeth, the whole forming substantially one piece.) The material composing the plate must, when hardened, be an elastic material possessing and retaining in use sufficient strength and rigidity for the purpose of mastication, and at the same time being elastic enough to yield a little to the motions of the mouth.

It may be said here as further illustrating my idea of what the invention is, that it does not consist in the mere application of vulcanite or a substance possessing the same characteristics for the required purpose in place of metal. For instance, if a plate of vulcanite were formed into proper shape, and the teeth were then riveted to it as they have been to a metal plate, then the completed article with the teeth riveted to the vulcanite would not be the new article of manufacture described in the Cummings patent.

A plate constructed on Cummings' system possesses qualities which clearly distinguish it from all the sets of teeth preceding it. In
236 the first place it fits better, as the dentist is enabled to form the plate upon the original plaster model of the mouth, thus dispensing with the difficult and inaccurate process of constructing dies, and counter-dies, and stamping the plate up between them. The result is necessarily an *an* accuracy of fit not to be attained by the old method. In the second place, there is a much tighter joint (I may say a perfect joint) between the teeth and the plate than is found in the old plates where the porcelain teeth are riveted and soldered to a metal plate, and thus cleanliness and purity are attained by the use of the Cummings plate, owing to the absence of crevices and cavities between the teeth and plate into which, when they exist, fluids from the mouth are apt to enter and decompose. In the third place the teeth, when imbedded in an elastic material, possessing and retaining in use sufficient rigidity and strength for the purpose of mastication, and at the same time elastic enough to yield a little to the motions of the mouth, are capable of yielding, when subjected to the pressure of the opposing jaw, about as much as the natural teeth yield in their sockets, thus avoiding the shock

that would result from the teeth being rigidly held by a hard non-elastic material.

I do not consider that Cummings' invention is dependent upon the chemical composition of the plate any more than it depends upon the chemical composition of the artificial teeth. It is only necessary, in order to apply his invention, that teeth should be used possessing substantially the physical characteristics of artificial teeth, and that they should be embedded in a plate possessing substantially the characteristics of a vulcanite plate for the purpose for which it is to be used. The physical characteristics of the substance which forms the plate, in order to fit it for holding artificial teeth in substantially the manner described in Cummings' patent are, first, capability of being formed, or moulded around the roots of the teeth and pins while in a soft or plastic condidition; and, second, strength and elasticity when hardened, such as is possessed by whalebone, ivory, vulcanite and solid collodion, so that it shall be sufficiently strong and rigid for the purpose of mastication, and at the same time elastic enough to yield slightly to the pressure of the jaw.

Some fourteen or fifteen years ago I made for the India Rubber Comb Company a long series of experiments upon vulcanite, and became familiar with the qualities of that substance, and its behaviour during the vulcanizing. When the vulcanizable compound is subjected to heat the effect upon it is as follows: Before the heat is applied it
237 is a substance having about the consistency of tough or partly dried putty. The first effect of the heat is to soften the compound. It then grows softer and softer until it becomes of a consistency like thick tar. After being subjected a sufficient time to a proper heat, and allowed to cool, it becomes hard, strong, and elastic.

Vulcanite is an old and well known substance patented to Nelson Goodyear, in 1851. It may also, I have been informed, be produced by using gutta-percha in place of caoutchouc or India-rubber, the same being mixed with sulphur and subjected to heat in like manner.

(I am familiar with pure gutta-percha. It is not an elastic substance in the sense in which vulcanite is elastic. It has a sort of leathery pliability at ordinary temperatures. I have found, by actual experiment, that at 92° F., which is, I believe, the average temperature of the human mouth, it becomes so soft that it is not rigid enough for the purpose of holding artificial teeth during mastication, and also that it is incapable at the ordinary temperatures of a room, of holding teeth against a force less than that exercised in mastication.)

I have read the affidavit of Josiah Bacon, annexed hereto, describing the process of making dental plates of the elastic substance known as solid collodion, and especially of the particular article of solid collodi'n known to dentists and dealers in dental supplies under the trade designation of "Celluloid." The said process described in said affidavit must necessarily result in an article of manufacture containing all the features that I have herein stated as constituting the distinguishing characteristics of the vulcanite dental plate. I have examined many vulcanite dental plates and a considerable number of said solid collodion "or celluloid" dental plates, and after looking at and handling them was unable to decide which were vulcanite and which celluloid. In fact I picked out, in several instances, celluloid as vulcanite and vulcanite as celluloid. I then compared those composed of the one material with those composed of the other, and could distinguish no difference in their physical characteristics, except in their odor, and in the slight translucency possessed by solid collodion not deeply colored.

The celluloid dental plate is, in my opinion, substantially the article of manufacture described and claimed in the Cummings Patent. Both the celluloid and the vulcanite plates have the teeth supported by imbedding, have a close joint between the teeth and the substance which
238 supports them, both have sufficient strength, rigidity and elasticity, both are, as I am informed and believe, unaffected by the fluids of the mouth and usual food and condiments, and both by reason of being manufactured by moulding and pressure, without use of metal dies and therefore without danger of alteration of such dies during stamping, are almost, if not quite exact, fits to the mouth and alveolar ridge. I am also informed that users cannot distinguish, when in use, sets of teeth made of vulcanite from those made of celluloid. I am of the opinion previously expressed as to the substantial identity of the two articles, although I know that celluloid is a different chemical compound from vulcanite, because I believe that the substantial resemblance must be sought in those points or characteristics which are brought into play in actual use, and not in character'stics which are unimportant in such use.

HENRY B. RENWICK.

Subscribed and sworn to before me this 29th day of July, A. D. 1875
[L. S.] FRANCIS A. DANIELS,
U. S. Commissioner.

Complainants' Exhibit N.—J. A. S., ex'r.

65.

DEPARTMENT OF THE INTERIOR, U. S. PATENT OFFICE.

To all persons to whom these presents shall come, greeting:

This is to certify that the model in the matter of the application of John A. Cummings, filed April 12, 1855, for Artificial Palate and Gums, is not now in this office, having been lost several years since.

In testimony whereof I, W. H. Doolittle, Acting Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed, this twenty-third day of August, in the year of our Lord one thousand eight hundred and seventy-six, and of the Independence of the United States the one hundred and first.

[SEAL.] W. H. DOOLITTLE,
Acting Commissioner.

239 NEW YORK, *August* 26, 1876—11 a. m.

Present, counsel as before.

Counsel for complainants offers in evidence the following notice and affidavit filed on behalf of complainants in the suit of the Celluloid Manufacturing Company vs. The Goodyear Dental Vulcanite Company, in the United States circuit court for the southern district of New York; the notice and affidavit is in the following words and figures, to wit:

(Counsel for defendants objects to the offer, and to the notice and affidavit as incompetent and irrelevant, and as not in rebuttal of any evidence offered by the defendants, but as an enlargement of complainants' case in chief, and counsel gives notice that at or before the hearing the court will be moved to expunge said notice and affidavit from the record, and it is now agreed that any objections insisted upon by either parties shall stand for hearing at the hearing of these causes without further notice.)

United States circuit court, southern district of New York.

THE CELLULOID MANUFACTURING COMPANY
vs.
THE GOODYEAR DENTAL VULCANITE COMPANY.

SIR: Please take notice that the annexed affidavits will be read upon the motion in this cause for a preliminary injunction—which motion, by order of the court, stands adjourned to Monday, March 6, 1876, at 11 a. m.

Dated March 2d, 1876.

Yours, &c.,

E. LUTHER HAMILTON,
Solicitor for Complainant.

UNITED STATES OF AMERICA,
Southern District of New York, ss:

M. Clifford Lefferts, being sworn, says:

Since making the affidavit herein, on the 8th day of February, 1876, further letters have been received by the Celluloid Manufacturing
240 Company, such as are referred to in the bill herein, and I annex copies of some of said letters, and I believe the statements therein made relating to the proceedings already taken or threatened against the writers thereof for the use of celluloid, to be true.

The Celluloid Co. has been notified by its agents within a few days past, that in consequence of the suits pending and threatened by the Goodyear Dental Vulcanite Co. against dentists who are using or who have heretofore used celluloid, large numbers of dentists throughout the United States have decided to give up the use of celluloid altogether, and to take out licenses from the Goodyear Dental Vulcanite Co., and in many cases orders for celluloid plates, in consequence of such suits and threats have been cancelled.

The agents of our co. also inform us, and I believe such informotion to be true, that unless the threats of prosecution by the Goodyear Dental Vulcanite Co., of the customers of our co. are stopped, the dentists will cease entirely to use celluloid, and that branch of our business will be wholly destroyed.

M. CLIFFORD LEFFERTS.

Sworn to before me this 24th day of February, 1876.

J. M. DENEL,
U. S. Com., S. D. of N. Y.

Tho objection heretofore taken does not extend to the form in which the foregoing notice and affidavit is offered.

Adjourned to Monday, August 28, 1876, at 11 o'clock a. m.

NEW YORK, *August* 28, 1876—11 a. m.

Deposition of Josiah Bacon.

Present, counsel as before.

JOSIAH BACON, a witness recalled on behalf of complainants, being duly sworn, testifies as follows:

Question 1. You have been examined as a witness previously in this case, have you not?

Ans. I have.

Ques. 2. State whether the complainants in these suits has any, and, if yea, what, interest in having dentists use one material rather than any other, in making up sets of teeth, covered by the Cummings patent?

241 (Objected to as incompetent and irrelevant, and as not in rebuttal of anything opened in the defendant's proofs.)

Ans. They have no interest in recommending one more than another.

Ques. 3. Does your business enable you to know the prices charged for sets of teeth, by dentists?

(Objected to as new matter, and not in rebuttal.)

Ans. It does.

Ques. 4. Please state the prices at which full upper sets of vulcanite or of celluloid, of good workmanship, are commonly sold to the poorer class of patients.

(Same objection, and further as incompetent.)

Ans. About ten dollars per set, is about the usual rate.

Ques. 5. How much for such full sets, consisting of an upper and a lower set?

(Same objection.)

Ans. I think from fifteen to twenty dollars is about the usual rate for such sets.

Ques. 6. What would be the price of a gold full upper set?

(Same objection.)

Ans. I think from sixty to eighty dollars. My information upon these points is derived from conversation with different dentists throughout the country.

Ques. 7. Are gold sets commonly made now by dentists?

(Same objection.)

Ans. But few dentists make them; metal plates being almost universally superseded by Cummings' dental plates.

Ques. 8. Are continuous gum sets commonly made by dentists? and state particularly your observation on the subject in the city where you reside.

(Objected to as a repetition of complainants' case in chief, and incompetent.)

Ans. They are made by but few; in Boston, I am not aware of any dentist making them.

Ques. 9. Will you produce a vulcanite partial set, and put it in evidence as an Exhibit in this cause?

(Same objection.)

Ans. I will; here is one.

(Set referred to offered in evidence, and marked Complainants' Exhibit vulcanized partial plate, J. A. S., Exr.)

242 Reserving the objections taken, counsel for defendant puts the following questions de bene esse:

Cross-ques. 10. Are you still treasurer of this corporation, the complainant?

Ans. I am.

Cross-ques. 11. Are you a stockholder in that company?

Ans. I am.

Cross-ques. 12. To what amount?

Ans. I have but about one hundred shares.

Cross-ques. 13. What is the par?

Ans. One hundred dollars per share.

Cross-ques. 14. Have you dealt much in this stock since 1873?
(Objected to as irrelevant.)
Ans. Only to a medium extent.
Cross-ques. 15. How much of this stock have you owned or held at any one time since you were examined in the Smith case?
(Same objection.)
Ans. I do not think I have owned over two hundred shares; I have held some in trust for absentees.
Cross-ques. 16. With power to sell it?
(Same objection.)
Ans. No, sir.
Cross-ques. 17. As treasurer of this company, do you receive a salary; and, if yea, what is the amount of it?
(Same objection.)
Ans. I receive a salary of five thousand dollars per year.
Cross-ques. 18. Do you get, in addition to that, any commissions or other allowances?
(Same objection.)
Ans. I get nothing in any manner, form or shape.
Cross-ques. 19. Have you got any dividends on stock?
(Same objection.)
Ans. I have whenever a dividend has been paid.
Cross-ques. 20. When, and what dividends have been paid on this company's stock since 1873?
(Same objection.)
Ans. A dividend of four dollars per share has been paid in 1876; a dividend of four dollars per share was paid in 1875; and, from memory, I think the same in 1874.
243 Cross-ques. 21. Are these the only distributions of the receipts made to stockholders during this time?
(Same objection.)
Ans. These four per cent. dividends are the only distributions whatever.
Cross-ques. 22. On what amount of stock were these dividends paid?
(Same objection.)
Ans. Fifteen hundred thousand dollars.
Cross-ques. 23. Please name the stockholders in this company, as far as you can.
(Same objeetion.)
Ans. There are over one hundred and sixty stockholders; hence it would be impossible for me to name them; much of the stock is owned in small amounts by dentists.
Cross-ques. 24. Can't you name some of them?
(Same objection.)
Ans. I can: Messrs. Cheever, Green, Richards, Robey, Gately, Souther, Duncan, Durant, Tappan, Brown, Livermore, Osgood, Eastham, Freeman, Dietrick; of course I can recall many others.
Cross-ques. 25. I want you to name all you can.
(Same objection; and the witness is reminded that he need not answer the question unless he sees fit; and objected to further on the ground that if the evidence is of any importance it should be proved by the production of the stock list on the books of the corporation.)
Ans. I will name a few others that occur to me: Messrs. Bacon, Simons, Wheeler, Thorndike, and Lamson; I can recall no others at the moment.

Cross-ques. 26. What sets of teeth do you claim are covered by the Cummings patent, other than sets of hard rubber or vulcanite?

Ans. I claim that celluloid sets are covered by the patent.

Cross-ques. 27. Anything else?

Ans. I claim that rose pearl sets are covered by the patent.

Cross-ques. 28. Anything else?

Ans. I claim that any dental plate made of a plastic material, in which the teeth are embedded while that material is in a soft condition, and then hardened, is covered by the patent.

Cross-ques. 29. Do you know of any plate made of such material, except hard rubber or vulcanite; and, if yea, what is the material?

Ans. I believe celluloid to be such material.

244 Cross ques. 30. How long have you known of celluloid plates being made by dentists?

Ans. Not to any extent, except within the past two years; prior to that I had heard of them, mainly as experiments in that line, and not claimed as practical.

Cross-ques. 31. What is the highest price you have heard of dentists charging for an upper set of vulcanite?

Ans. I do not think I ever heard of over thirty dollars being charged.

Cross-ques. 32. And for full sets, upper and lower, what is the highest?

Ans. I think fifty dollars is, to the best of my recollection, the highest I ever knew.

Cross-ques. 33. Among the better class of patients, and better provided dentists, is not twenty-five dollars an ordinary price for an upper set of vulcanite?

Ans. No, sir; that is a high price. Very few get over half of it.

Cross-ques. 34. Then the poorer class of patients have an advantage over the better class of only two dollars and a half; is that all?

Ans. Dentists charge usually, according to their reputation; there are high priced dentists as there are high priced hotels; I believe the majority of rubber plates made are at not over ten to twelve dollars.

Cross-ques. 35. What is the price at which the compound called dental rubber, prepared for dentist's use in making sets of teeth, is sold?

Ans. About two dollars and a half a pound.

Cross-ques. 36. Isn't it in sheets; each sheet about enough for a plate or set of teeth?

Ans. No, sir; a sheet will make more than one plate.

Cross-ques. 37. How many sheets make a pound of this prepared rubber?

Ans. Different manufacturers vary.

Cross-ques. 38. State the range of the variation in the number of sheets.

Ans. I think they will average from fifteen to the pound.

Cross-ques. 39. Does your business lead you much into communication with dentists who make gold plates or continuous gum sets?

245 Ans. I have communication with great numbers of dentists, but know of few making gold, and still less continuous gum.

JOSIAH BACON.

Subscribed and sworn to before me this 28th day of August, 1876.

It is consented that each party may retain and produce before the court, on the hearing hereof, their exhibits other than documentary; and it is further agreed that any printed depositions or exhibits used herein, under stipulation or otherwise, shall be subject to correction of

any errors found therein by comparison with certified copies, or with original on file.

Complainants' counsel give notice that the taking of testimony in these causes will be resumed at the office of the Goodyear Dental Vulcanite Company, 5 Temple Place, Boston, Mass., on Friday, September 1, 1876, at 11 o'clock a. m.

Adjourned to said time and place.

EVIDENCE FOR COMPLAINANTS IN REPLY.

Taken pursuant to the 67th rule of the Supreme Court of the United States, in equity, as amended, before me,

JOHN G. STETSON,
Examiner.

Present, E. N. Dickerson, esq., and B. F. Lee, esq., of counsel for complainants; Henry Baldwin, jr., esq., and E. Luther Hamilton, esq., of counsel for defendants.

Deposition of Volney D. Nute.

BOSTON, *September 1st*, 1876.

Direct examination by counsel for complainants:

Interrogatory 1. Please state your name, age, residence, and occupation.

Answer. Volney D. Nute; 31; Boston, Mass.; dentist.

Int. 2. Where are you employed, and how long have you been employed in that place?

Ans. At 25 Tremont st., with Flagg & Osgood, Boston, Mass. I have been there 13 years the 1st of November next.

246 Int. 3. What position do you occupy in that establishment?

Ans. Have charge of the laboratory and execute the mechanical work.

Int. 4. Have you made sets of teeth recently out of blanks of vulcanized rubber; and, if so, at whose request did you perform that operation?

Ans. I have, and at Mr. Bacon's request.

Int. 5. What apparatus did you use for the purpose, and where did you procure it?

Ans. The celluloid steam-molding apparatus, similar to that described and shown by a drawing in Complainants' Exhibit Hyatt No. 2; of Sam'l S. White, Tremont Row, Boston. I procured it on the 24th of August last.

Int. 6. Had you ever used an apparatus similar to that for any purpose before that time?

Ans. I have used a glycerine apparatus, but not for rubber. I never used a steam apparatus at all; in fact I never knew anything of the working of it up to this time.

Int. 7. What is a glycerine apparatus?

Ans. An open iron vessel with a screw clamp.

Int. 8. How did you make your vulcanite blank and what model did you use for producing it, and will you produce a specimen of the vulcanite blank you made?

Ans. The mold was taken from No. 4 celluloid blank and vulcanized in the usual way; I produce a specimen of it made of the star rubber,

which is the kind generally used during the last 10 years in making vulcanite sets.

(The exhibit is produced and marked Exhibit Nute No. 1, J. G. S., Examiner.)

Int. 9. State what you next did with the vulcanite blank so produced.

Ans. A set of plain teeth was set up in the form for moulding the celluloid, and I used the rubber blank instead of the celluloid blank, moulded in the steam apparatus the same as the celluloid.

Int. 10. State the process.

Ans. The blank was placed in the mould and the mould put into the steam apparatus, same as shown in Complainants' Exhibit Hyatt No. 2; heat up to 310° of heat, and the flask forced together by the screw the same as celluloid, allowed to cool and taken out with the same result as the celluloid.

247 Int. 11. In screwing down the flask, how did the force required compare with the force required to screw down a celluloid blank?

Ans. The same; no difference.

Int. 12. Have you any specimens of sets of teeth so prepared? If so, please produce them.

Ans. Yes, sir; I have two, and produce them.

(The specimens produced are marked Exhibit Nute No. 2 and Nute No. 3, J. G. S., Examiner.)

Int. 13. What are the parts wired together with these exhibits?

Ans. These are pieces of the vulcanized blank taken off before the blank was put into the apparatus for forming the set of teeth; and the small piece of metal attached to Exhibit 3 is the air chamber formed, upon which the air chamber of the set of teeth was moulded.

Int. 14. How many times did you try the experiment in producing these sets of teeth?

Ans. Four different times, including the two exhibits.

Int. 15. What is the character of the sets exhibited?

Ans. No. 3 is a perfect set of artificial teeth made from an impression from the mouth of a patient for whom we are making a set of teeth now. No. 2 is made from an impression from a set of artificial teeth.

Int. 16. Are you able now to produce practically perfect sets of teeth by that process?

Ans. As much so as if celluloid was used.

Int. 17. Were the first two sets you tried perfect?

Ans. The first one was a failure; the second was a success; the third was a failure, and the fourth was a perfect set of teeth in every respect.

Int. 18. What difficulties in the apparatus, if any, did you encounter in making these sets of teeth?

Ans. None at all after I had got to understand the working of the apparatus.

Int. 19. Did you experience any difficulty in the beginning, in working the apparatus, and what was it?

Ans. At first I could not tell when the flask had been forced together, not having had any experience with the apparatus.

Int. 20. Did you resort to some means to ascertain when it was forced together?

Ans. Yes, sir; I placed a flask which was together in the steam apparatus—forced the screw plump down on the flask—made a mark

248 on the outside of the plunger showing when the flask was together; and I had a steam-cock attached to the apparatus to let off the steam and cool it more readily, and prevent further vulcanizing after the flask was secured together. The blank was properly vulcan-

ized sufficiently before it was put in, and there is such a thing as having the rubber vulcanized too much.

Int. 21. Look at the machine marked Exhibit Nute No. 4, and state how long you have known the apparatus, and for what purpose it has been used.

Ans. I have known that apparatus for 12 years. It is similar to the celluloid clamp screw. It is used for forcing dental flasks together for packing vulcanite rubber.

Int. 23. Has it been so used in your establishment, ever since you knew it?

Ans. It has.

Cross-examination by HENRY BALDWIN, JR., esq., of counsel for defendants:

Cross-int. 23. Please give the first names of your employers, Messrs. Flagg & Osgood.

Ans. George H. P. Flagg and Herman D. Osgood.

Cross-int. 24. Did you ever make a vulcanite blank similar to Exhibit Nute No. 1, before you made these experiments about a week ago?

Ans. No, sir; I did not.

Cross-int. 25. Did you do all that you testified about in one day?

Ans. No, sir.

Cross-int 26. How many days or parts of days were you at it altogether?

Ans. The first day I made the blanks, nothing more; the second day I moulded a set of teeth which was a failure—that was on the 25th; the 24th I commenced. I made more blanks on the 26th which I did not use, for the reason that they were imperfectly vulcanized; and on Monday last I was requested by Mr. Bacon to make him two sets of teeth in this way. I made two blanks on Monday and set up a set of plain teeth in the usual way for packing the celluloid, and used my vulcanized rubber blank in place of the celluloid, and Exhibit Nute No. 2 is the set which I made at that time from that blank. I did nothing on Tuesday; on Wednesday I put up a set of teeth in the same form
249 as the one before, and failed to get the flask together, not knowing when the screw clamp was properly down on the flask, which I found was not. On Thursday (yesterday) I went through with the same form as described previously, and produced a perfect set of teeth, to wit, Exhibit Nute No. 3.

Cross-int. 27. How many rubber blanks did you vulcanize, or attempt to vulcanize, during the course of these experiments?

Ans. I could not say exactly, not having kept an account of the number. I should say seven of them.

Cross-int. 28. And Exhibits Nute Nos. 1, 2, and 3 are three of them, are they?

Ans. Yes, sir.

Cross-int. 29. Did you destroy the others or any of them?

Ans. They were not properly vulcanized; that is, some of them, for that reason I destroyed them.

Cross-int. 30. Have you any of them yet that you did not destroy?

Ans. Yes, sir; this is one of them.

(With the consent of witness and of counsel for complaintants the blank referred to is put in evidence and marked Exhibit Nute No. 5, J. G. S., Examiner.)

And witness adds: This is the only one I have, and did not use it because it was over-vulcanized.

Cross int. 31. In making these experiments, did you find the other three blanks over-vulcanized or under-vulcanized ?

Ans. Not vulcanized enough to be called hard rubber; that is, not susceptible of a polish. When it is susceptible of a polish, I term it hard rubber.

Cross-int. 32. Had you any assistance, suggestion, or instruction from any one; and, if yea, from whom, in making these experiments ?

Ans. I had no assistance or suggestion at all from any one. I was simply requested by Mr. Bacon to make teeth in this way, but no instructions.

Cross-int. 33. You say you have been with Flagg & Osgood about 13 years. During that time how much have you done in the way of vulcanite work, or making sets of teeth on hard rubber or vulcanite ?

Ans. Well, more or less of it, every day since I have been there with them.

Cross-int. 34. Is Exhibit Nute No. 5 susceptible of a polish ?

250 Ans. It isn't required to be so hard as that, or so much vulcanized for a polish.

Cross int. 35. What objection is there to it, by reason of its being over-vulcanized ?

Ans. It would not mould so well in this mould as one properly vulcanized.

Cross-int. 36. Is it brittle or burned, or rotten, as it would be designated in certain cases ?

Ans. It has lost its elasticity; there is more or less elasticity to it.

Cross-int. 37. Is it so much overdone that you would call it (speaking technically) rotten ?

Ans. I should call it brittle, not so strong as that properly vulcanized.

Cross-int. 38. In what sense has it any elasticity left in it ?

Ans. Capable of being moulded or bent by heat without breaking.

Cross-int. 39. How long was this Exhibit Nute No. 5 subjected to the vulcanizing heat ?

Ans. For an hour and a quarter at 320° of heat, I think, that was vulcanized—am not positive about that.

Cross-int. 40. What variation in the duration and in the degrees of heat did you adopt in making the seven vulcanite blanks ?

Ans. Some were vulcanized at a higher and a lower degree of heat for different periods of time. The blank of Exhibit Nute No. 3 was vulcanized at 310° for fifty minutes. The blank of Exhibit Nute No. 2, 310°, for forty-five minutes. Exhibit Nute No. 1 was vulcanized for an hour and a quarter, 315°.

Cross-int. 41. How about the other three ?

Ans. They were not vulcanized enough to be called hard rubber; they were vulcanized at 300°, for forty minutes.

Cross-int. 42. Is Exhibit Nute No. 1 over-vulcanized ?

Ans. It is; that is, it isn't required to be vulcanized so hard to be called hard rubber.

Cross-int. 43. Is it in the same condition as to texture and elasticity as Exhibit Nute No. 5 ?

Ans. There is but very little difference.

Cross-int. 44. How much has the plate of Exhibit Nute No. 3 been reduced since it was moulded to the teeth ?

Ans. It came out of the flask a trifle thicker than it is now, just polished down on the outside and not any on the inside.

251 Cross-int. 45. In giving the time during which the vulcanite blanks were made, have you given the time during which the

blanks were subjected to the vulcanizing heat after the flask was closed; or have you included the time taken in closing the flask in each case?

Ans. The time given is from the time it was heated at the vulcanizing point to the time it was taken out.

Cross-int. 46. In each case the mixed rubber was packed in the flask, and the flask closed tight before it was put into the vulcanizer; was that so?

Ans. Yes, sir, as to all the blanks we have spoken of. Here is another case of gum teeth set up in the usual way for making celluloid or rubber, which I made by putting the unvulcanized rubber in the mould or flask, and then put in the celluloid apparatus, and forced the flask together the same as for celluloid, and vulcanized in the celluloid apparatus, the same as in the Hayes vulcanizer, with this result, a perfect set of teeth.

(The set of teeth produced by the witness is put in evidence and marked Exhibit Nute No. 6, J. G. S., Ex'r.)

Cross-int. 47. In packing the flasks for the vulcanite blanks we have spoken of, what degree of heat did you use, and how did you obtain it in packing the flask and bringing it together before they were put in the vulcanizer?

Ans. They were put into an open vessel of water and heated to the boiling point, which is 212°, and then clamped or screwed together.

Cross-int. 48. Do I understand you rightly, that the flask was brought up to 212° temperature?

Ans. Yes, sir.

Cross-int. 49. How long did it take to heat the flask up and clamp or screw it together, as you have described, ready to be put in the vulcanizer?

Ans. I should say ten minutes.

Cross-int. 50. Was the flask at this temperature when put into the vulcanizer?

Ans. I should say it was, about that.

Cross-int. 51. What was the temperature in the vulcanizer when the packed flask was put in?

Ans. 212°, or boiling heat.

Cross-int. 52. How long did it take after the flask was put in to raise the temperature in the vulcanizer to the vulcanizing heat you have mentioned—300, 310, and 315 degrees?

252 Ans. 300° is, I believe, the lowest vulcanizing heat. After the flask was put in, the top of the vulcanizer was put on steam-tight, and the heat run up to 260°, which took twenty minutes; allowed to remain in there for half an hour; then the heat was gradually increased to 30 .°, or the vulcanizing point, which took 40 minutes' time, and allowed to remain at that temperature the different times mentioned, as I have previously stated, to produce the different results I have stated. Had the heat not been run up gradually, consuming that amount of time, the rubber blank would have been porous or cellular, owing to the thickness of the body.

Cross-int. 53. Was the flask left in the vulcanizer to cool, or was it removed therefrom at the end of the vulcanizing period you have mentioned?

Ans. It was removed at the time of the vulcanizing period mentioned.

Cross-int. 54. Was the cooling of the flask precipitated in any way, or was it left merely to cool in the atmosphere?

Ans. The steam was let off through a steam-cock in the vulcanizer;

the flask with rubber removed, and cooled in ice water, and the rubber blank taken from the flask, with these results.

Cross-int. 55. To be clear about it, am I right in understanding that the periods you have mentioned, during which the packed flask in which these vulcanized blanks were made were subjected to the vulcanizing temperature, did not include the time required to bring the flask up from 212° to the vulcanizing temperature?

Ans. It did not include the time it took to run it up to the vulcanizing temperature.

Cross-int. 56. In vulcanizing rubber sets of teeth during your employment with Messrs. Flagg & Osgood, and aside from these experiments, what sort of apparatus has been used?

Ans. Nothing, except the screw clamp and the vulcanizer.

Cross-int. 57. With steam heat only?

Ans. With steam heat; but rubber can be vulcanized with dry heat. The reason for using steam heat is because it was the first way in which rubber was vulcanized, and it answers every purpose; but dry heat can be used to vulcanize as well, if you have a uniform heat.

Cross-int. 58. How long have you known steam heat to be used for vulcanizing rubber?

Ans. 16 years.

Cross-int. 59. Have you known dry heat to be used for vulcan-
253 izing rubber sets of teeth; and, if yea, when and where, and to what extent?

Ans. About nine years ago a man by the name of Warren, who was one of the first manufacturers of the steam vulcanizer, came to 25 Tremont st., Boston, where I am located, and made experiments dry heat, using mercury in place of water or steam, with good success, but an expensive way of vulcanizing, therefore not brought into use.

Cross-int. 60. How was this mercury used in place of water or steam in this method?

Ans. In a similar manner to the water or steam, and with a tube attached to carry off the evaporated mercury.

Cross-int. 61. Was the flask immersed in the mercury?

Ans. Yes, sir; it was—the same as it was in the water or steam.

Cross-int. 62. You say that you have used a glycerine apparatus, but not for rubber. What did you make in the glycerine apparatus?

Ans. Sets of teeth on celluloid blanks.

Cross-int. 63. You say you never used a steam apparatus at all prior to this one you procured on the 24th of August last—in fact, you never knew anything of the working of it up to that time. Isn't there some mistake about that answer?

(Question and answer 6 read to witness.)

Ans. No; I never did know anything about a steam apparatus up to that time—the 24th of August last.

Cross-int. 64. How have you been vulcanizing rubber sets of teeth at Flagg & Osgood's for the past 13 years?

Ans. By the Hayes vulcanizer, by the process before described for vulcanizing rubber.

Cross-int. 65. Then you have been using a steam apparatus for vulcanizing rubber thirteen years, have you?

Ans. Yes.

Cross-int. 66. In what particular does this apparatus which you have been using for 13 years differ from the celluloid steam apparatus which you procured on the 24th of August last?

Ans. This celluloid molding apparatus has a screw plunger going through the top, for forcing the flask or molds together. The vulcanizer which I have used for the past 13 years is the same, with the exception of the screw plunger. I have not used the plunger, having brought the flasks or molds together with a screw-clamp like Exhibit Nute No. 4 before putting into the vulcanizer which I now use and have used for 13 years.

254 Cross-int. 67. In vulcanizing rubber, then, you have clamped and screwed the flasks together and simply set it in the vulcanizer and closed the vulcanizer, without having any pressure upon the flasks except the screw pressure?

Ans. Yes; I had a pressure on the flask to keep it together while in the vulcanizer. After clamping it together, I held it there by three screw bolts, and then it was put into the vulcanizer under the pressure of those three screw-bolts.

Cross-int. 68. But you had no pressure upon the flask except these clamping screw-bolts which kept the two parts together?

Ans. None other.

Cross-int. 69. Did you ever make a set of teeth on a celluloid base by packing and clamping together the flask and putting it into the vulcanizer, without any pressure except that of the screw-bolts, as last mentioned?

Ans. No, sir; for there is no occasion for it, the celluloid base being hard, and not requiring vulcanizing the same as rubber.

Cross-int. 70. Did you ever vulcanize a rubber set in a glycerine apparatus or an oil apparatus?

Ans. No, sir; I did not.

Cross-int. 71. Do you know if you could get the two parts of the flasks together, with a celluloid blank in the flask, without a plunger or similar pressure?

Ans. No, sir; you could not without using a plunger or a screw-clamp.

Cross-int. 72. Do you know the proportions of the gum constituted in the dental rubber you have used during the last ten years in making vulcanized sets of teeth?

Ans. I did know at one time, because I used to manufacture that which we used, which is the same as the star rubber now. I think it is about one part rubber to two of sulphur and two of vermilion, by weight. I have forgotten now. There is more foreign matter than pure rubber, and a large amount of coloring matter. It takes a large amount of coloring matter to change it from a dark brown or black.

Cross-int. 73. When you had got the vulcanite blank, as you have described, and the mould with the teeth in it, you placed the blank of vulcanite in the mould and clamped the other half of the flask down upon it by means of the plunger in the celluloid moulding apparatus, did you not?

255 Ans. Yes, sir; the same as with a celluloid blank.

Cross-int. 74. Didn't this process differ from that of making a rubber set of teeth in the respect that the flask was not closed nor ever packed when it was put into the vulcanizer?

Ans. Yes, sir; it did, for the reason that it was brought into shape the same as the celluloid blank.

Cross-int. 75. Was the flask with the vulcanite blank in it heated before being put into the vulcanizer?

Ans. No, sir; it was not. It was moulded in the same way that I would mould celluloid by the steam apparatus.

Cross-int 76. How long did you keep the vulcanite blank in the flask and under the pressure of the plunger after you placed the flask in the vulcanizer?

Ans. The rubber blank with the teeth, in a flask or mould, was put into the celluloid steam apparatus, the top put on, making it steam-tight, heat applied until the thermometer indicated 310° of heat, and the flask forced together by the plunger or screw-clamp, taking about ten minutes to bring it together. Immediately taken out and cooled off, with this result—Exhibit Nute No. 3.

Cross-int. 77. From the time you put the flask, with the vulcanized blank and the teeth, in the vulcanizer, until you brought the flask together, how long was it?

Ans. It took 15 minutes to bring the heat up to 310°, and ten minutes to bring the flask or mould together—in all, twenty-five minutes.

Cross-int. 78. How many sets of teeth did you attempt to make with vulcanite blanks?

Ans. Four sets.

Cross-int. 79. In the cases of the two failures you have mentioned, what was the defect in the result attained with those two sets?

Ans. The blanks was too much vulcanized to mould well.

Cross-int. 80. Is the piece which is wired to Exhibit Nute No. 2 a piece of the vulcanite blank from which that exhibit is made, or is it from a different blank?

Ans. It is from the same blank.

Cross-int. 81. Is the same true of the piece that is wired on to Exhibit Nute No. 3?

Ans. It is; showing the place from which it was sawed off of the blank.

256 Cross-int. 82. In moulding these sets of teeth from the vulcanite blank, did you use plaster mould, the same as you have always used in making vulcanite work, or did you make any special composition for these moulds?

Ans. The same as I have used for making vulcanite and celluloid both.

Cross-int. 83. Who finished up the sets Exhibit Nute 3?

Ans. I finished it. I did all the work on them that has been done on them.

Cross-int. 84. In Exhibit Nute No. 3, were the indentations in *in* the gum between the teeth produced in the plate mould?

Ans. Yes; done in the mould; simply polished off.

Cross-int. 85. In this Exhibit Nute No. 3 are the joints on each side of the teeth and between them what you would call perfect joints?

Ans. They are. It is what is known as a perfect set of teeth on a rubber base.

Cross-int. 86. Are there not crevices between the teeth and the plate in Exhibit Nute No. 3—for example, the left incisor, or second tooth from the centre on the left?

Ans. That you find in all sets of teeth, celluloid and rubber, packed in the ordinary way. You will find it more so in the celluloid, owing to the evaporation of the camphor. Also in rubber sets made in the ordinary way, from shrinkage of the rubber, when it is not set up in form exactly as you wish to have it—that is, when you have a large body of rubber to cut away, you will find this shrinkage.

Cross-int. 87. Are the teeth in this Exhibit Nute No. 3 the same kind of teeth with the same kind of pins that you have always used in your rubber work at Flagg & Osgood's?

Ans. Yes, sir; they are the same teeth used for rubber and celluloid with two platinum pins in each tooth. The teeth are S. S. White's manufacture. He makes the best teeth that are made in the world.

Cross-int. 88. Is it your opinion that Exhibit Nute No. 3 is as perfect a set of teeth as those ordinarily made of rubber vulcanized in the regular way, instead of being made, as this set was, on a vulcanized blank?

Ans. I believe it is as perfect.

Cross-int. 89. Is it usual in vulcanite sets to find such crevices between the teeth and the plates as exist in this Exhibit Nute No. 3? Were his these middle teeth?

257 Ans. Yes, sir, it is. These teeth in this case I have every reason to believe are as firmly fastened to the rubber as those made in the ordinary way of vulcanite or of celluloid.

Cross-int. 90. The Exhibit Nute No. 2, there has been no polishing done, I understand. Is that right?

Ans. That's right.

Cross int. 91. Are not the crevices between the teeth and the plates in that Exhibit Nute No. 2 unusually open?

Ans. No, sir, they are not. The polishing of the plate would work these edges down thin and burnish them to the teeth.

Cross-int. 92. Were the crevices in Exhibit Nute No. 3 before it was polished as open as those in this unpolished Exhibit Nute No. 2?

Ans. They were the same, though this Exhibit Nute No. 2 was made from a different shaped mouth, and some shapes pack better than others, both rubber and celluloid.

Cross-int. 93. Would not there be in the use of such plates as Exhibits Nute Nos. 2 and 3 an accretion of particles of food, or deposits from the juices of the mouth between the teeth and the plate?

Ans. No more than teeth set up in any other way, or on any other material. Fosil will get up in any set of teeth, or rather secretions from the juices of the mouth.

Cross int. 94. Have you not found such secretions or deposit between the teeth and plate in sets of hard rubber or vulcanite made in the same way, after they had been used for a time?

Ans. Yes, sir, on vulcanite and on all other material used.

Cross-int. 95. In the vulcanite work done at Flagg & Osgood's while you have been there, what proportion of the sets of teeth made have been made with gum teeth and block teeth such as those in Exhibit Nute No. 6?

Ans. The most of the vulcanite sets of teeth manufactured there are, and have been, gum teeth or block teeth.

Cross-int. 96. The Exhibit Nute No. 6, I understand you to say, was made in the celluloid apparatus, and in the same manner as you have described respecting Exhibits Nute No. 2 and Nute No. 3, except that instead of using the vulcanite blank, you packed the unvulcanized rubber in the mould, and vulcanized it on the teeth in the first instance. Is that correct?

Ans. I used the plunger to force the flask together in the celluloid apparatus, and vulcanized it in the celluloid apparatus the same
258 as I have been in the habit of doing in the Hayes vulcanizer, instead of using a vulcanite blank as I did in Exhibits Nute Nos. 2 and 3.

Cross-int. 97. How long did this occupy in Exhibit No. 6, and what temperature or temperatures?

Ans. It took ten minutes to bring the flask together; fifteen minutes

to reach the vulcanizing degree, and remained there one hour and a quarter, at 310 degrees.

Direct examination resumed:

Int. 98. How does the extent of professional business done by Flagg & Osgood compare with that of any other dental establishment in New England?

Ans. The dealers of whom we buy our supplies say that we do the largest business of any in New England, and not second to any one in the kind of work done.

Int. 99. Are you prepared to do all kinds of dental work which may be required?

Ans. Yes, sir; all kinds known of.

Int. 100. Do you manufacture celluloid sets whenever called for?

Ans. Yes, sir; we do, and have from the first of its being offered for sale, some five and a half years ago. We were experimenting on something similar before that. It wasn't celluloid, because we never used camphor in it—as far back as eight years ago. We have used what is called rose pearl, about ten years ago, a similar thing to what is called celluloid.

Int. 101. Which is easier to make, a vulcanite set or a celluloid set?

Ans. It is easier to make an ordinary vulcanite—more sure of success with bunglers. I don't see how a person can fail to make a set with rubber, but I do with celluloid where it is not nicely manipulated.

Int. 102. How many gold plates are called for now, in your establishment, in a year?

Ans. I don't remember but one full set having been made the past year; but we make partial plates, gold and silver, often.

Int. 103. Do you mean by "partial sets" those that are held by clasping the natural teeth?

Ans. Most of them are made in that way.

Int. 104. You said that you cooled off your blanks after they are vulcanized, by dipping the mould into ice-water. Why did you do that?

259 Ans. Simply to sooner get at it.

Int. 105. Suppose after the steam was blown off from the vulcanizer and the flame extinguished under it, the flask was left to cool off gradually; would it make any difference in the result so far as the character and quality of the plate is concerned?

(Objected to as incompetent.)

Ans. None at all, I might say; nothing perceptible.

Int. 106. Do you cool off your celluloid cases when they come out of the steam, by immersing them in cold water?

Ans. Yes; cool them the same as the rubber.

Int. 107. In making the set of teeth with the vulcanized rubber blank, does it require any more time or trouble than if the celluloid blank were used?

Ans. No difference in time.

Int. 108. In vulcanizing the blanks which you used for making these sets of teeth, did you pursue any different process from that which you would have pursued if you had been vulcanizing a set of teeth, set up in a soft mixed rubber base?

Ans. None at all; the same.

Int. 109. Does it make any difference in the process, whether the flask is held shut by the screw plunger, which squeezed it together during the vulcanization; or whether it is held shut by other screw bolts in the position in which it is left by the plunger?

Ans. None at all; it is the same thing.

Int. 110. Would not weights piled upon a plunger answer the same purpose as the screw-plunger?

(Objected to as leading.)

Ans. It would answer the same purpose.

Int. 111. Is the foreign matter incorporate with the rubber preparatory to its use as a dental plate objectionable, so far as you know?

Ans. Not when mixed the same or similar as the "star rubber."

Int. 112. Can you give, approximately, the number of vulcanite plates, of celluloid plates, and of gold, platinum, or silver plates, made in a year by Flagg & Osgood?

Ans. I should think about 700 a year of all kinds, including partial sets. Well, I should say 600 of them were rubber; the others would be gold and silver, celluloid and other substances.

Int. 113. About what proportion of these last are celluloid?

260 Ans. About a fifth; none are made except when specially called for; we talk them out of it; we think rubber is preferable. We had as good success with celluloid as anybody else.

Int. 114. When did you last make a continuous gum set?

Ans. About 13 years ago; I have not made any since I have been with Flagg & Osgood.

Int. 115. What is the class of your patrons in respect to their b ility to pay for the best thing?

Ans. We have the middling and the upper classes of people. Our patrons want first-class dentistry and don't question the price. We have our price and don't deviate from that one cent.

Cross-examination resumed:

Cross-int. 116. What is the price at your establishment for a set of upper and lower full set of vulcanite?

Ans. The price is $50 for rubber or celluloid and $150 for the same thing in gold.

Cross-int. 117. What is the price of the full upper set in vulcanite or celluloid?

Ans. Twenty-five dollars for the upper and twenty-five dollars for the lower, making $50 for the upper and lower.

Cross-int. 118. Has there not been any continuous gum work done at Flagg & Osgood's for 13 years?

Ans. Not any at all, for the reason that we know it to be inferior to all others.

Cross-int. 119. Are they prepared to do that kind of work?

Ans. No, sir; not at this present time. We have that kind of work there which was made there some years ago; we have samples of it.

Cross-int. 120. Has rose pearl any camphor in it?

Ans. Yes, sir; I have seen some that had camphor in it, and some without it.

Cross-int. 121. In making sets of rose pearl, don't you have to use a metal mould instead of a plaster mould?

Ans. We use a metal mould for that without the camphor, and that with the camphor the same as the celluloid. We mould that with the camphor the same as we would the celluloid, in plaster casts.

Cross-int. 122. When did you first know of rose pearl with camphor in it, so that you could mould it in plaster casts, same as the celluloid?

Ans. The last spring was the first with camphor.

261 Cross-int. 123. In vulcanizing a set of rubber, does it make any difference whether the flask is closed before or after it is put in the vulcanizer?

Ans. It does not.

Cross-int. 124. In vulcanizing a set of rubber, does it make any difference whether or not the flask is closed before the heat is raised to the vulcanizing temperature?

Ans. It should be closed before it reaches to that temperature.

Cross-int. 125. In making celluloid sets, do you use in your practice plain teeth generally?

Ans. No, sir; we use gum teeth in most cases.

Cross-int. 126. Do you know what the coloring matter used in the rubber is, chemically speaking; is it not oxide of mercury?

Ans. It is known as vermilion; chemically, it is an oxide of mercury.

Direct examination resumed:

Int. 127. Is the coloring matter used in rubber any different chemically from that used in celluloid?

Ans. The same, I think. In neither case can it come out, and it is not objectionable in either case.

VOLNEY D. NUTE.

Attest:

JOHN G. STETSON,
Examiner.

Deposition of I. Smith Hyatt.

BOSTON, *September* 2, 1876.

Direct examination by counsel for complainants:

Interrogatory 1. You have been previously examined as a witness in this cause?

Ans. I have.

Int. 2. Please look upon the paper now shown to you and say whether or not it was issued by the Celluloid Manufacturing Co.; and, if yea, when?

(Counsel for defendant objects to the question and to the introduction of the paper referred to, as incompetent and irrelevant, and not in rebuttal of anything offered on the part of the defendant.)

Ans. It was issued by the Celluloid Manufacturing Co., I see by the date, on the 2d of March, 1876.

262 Int. 3. How many were issued and distributed, and to what class of persons?

(Same objection.)

Ans. I don't know; I had nothing to do with it.

Int. 4. Do you not know that that circular was issued and generally distributed among the dental profession?

(Same objection.)

Ans. I do not.

Int. 5. Do you not know that it was issued for the purpose of distribution to the dental profession?

(Same objection.)

Ans. I have no doubt that was the case.

Int. 6. Do you not know that some of them were distributed?

(Same objection.)

Ans. I do not.

Int. 7. You have stated in a previous examination in this case that you were examined as a witness in the case against Adolph P. Preterre, in New York. Was not that on the 18th of June, 1875?

(Same objection; and further objected to because the witness has already been examined as to this matter, and it is not competent for the complainants to recall him and re-examine him respecting the same.)

Ans. I believe it was; it so appears in the record.

Int. 8. Was not Mr. Baldwin present with you on that occasion, at Mr. Schieffelin's office?

(Same objection.)

Ans. He was.

Int. 9. Were you not present at the closing of the proofs in the said Preterre case, and was that not on the 11th day of October, 1875; and were not Mr. Hamilton and Mr. Baldwin also present on that occasion?

(Same objection.)

Ans. I was present on an occasion when Henry B. Renwick was examined, and was cross examined by Mr. Baldwin, and whether that was at the closing of the testimony or not, I don't remember. It was some time during the latter part or fall of last year, according to the best of my recollection. Mr. Hamilton was there part of the time.

263 (The circular referred to was offered in evidence and marked Complainants' Exhibit Hyatt No. 6, J. G. S., Examiner.

Same objection to the offering of the exhibit.)

No cross-examination by counsel for defendant.

I. SMITH HYATT.

Attest:

JOHN G. STETSON,
Examiner.

Complainants' Exhibit Hyatt No. 6—J. G. S., Ex'r.

CELLULOID MANUFACTURING CO.,
Newark, N. J., Feby 17, 1876.

To the Dental Profession:

We do not propose to inflict upon the dental profession a continuous shower of circulars in reference to the dispute between celluloid and vulcanite, but the interests of dentists as well as our own require that the real facts as to the controversy should be fully known. We, therefore, respectfully request them to read this carefully and retain it for future reference.

With the long and continued contest over rubber we have nothing to do; it is alone with celluloid we have to deal, and we are prepared and willing to defend all those using it, against the suits of the Goodyear Dental Vulcanite Company and Mr. Bacon; but to enable us to do this intelligently we must have the co-operation of dentists themselves.

A circular, signed by Josiah Bacon, dated "Boston, February 4th, 1876," has been issued to the dental profession, for the purpose, as it is claimed, "of stating correctly the precise position of the litigation between celluloid and vulcanite." Now, if Mr. Bacon really desired to give correct information, it is somewhat strange that he should have suppressed the fact that the Celluloid Company had instituted a suit against the Goodyear Dental Vulcanite Company in the circuit court of the United States, in New York City, to obtain an injunction restraining Mr. Bacon and his company and its agents from harassing and threatening dentists all over the country who use celluloid; and by this suit to determine the question, once for all, whether the use of celluloid is an infringement of the Cummings patent. Mr. Bacon cannot plead that he did not know of such a suit, as the papers had been duly filed in

264 court and his counsel had been notified that such suit would be instituted before Mr. Bacon's circular was issued.

And further, when Judge Blatchford decided in favor of celluloid in the Flagg case, the Celluloid Company, nearly two months ago, published the whole of that opinion word for word. Mr. Bacon now comes forward and in order, as he says, "to correct gross misrepresentations" and to give the profession "correct" and full information on the subject, he gives a quotation of twelve words from that opinion, but even these words, as he quotes them, are not found in that opinion.

We were very much gratified when Josiah Bacon and the Goodyear Dental Vulcanite Company commenced a suit against Eben M. Flagg, of this city, for using celluloid. Dr. Flagg admitted its use, and we supposed we should have the chance of disposing of the question, but we were mistaken, as will hereafter appear, and as Mr. Bacon has misstated the facts in regard to that motion, and charged our company with delaying its hearing, we make the following statement in regard to it:

The Goodyear Dental Company gave notice that on August 4th, 1875, they would apply to Judge Blatchford for an injunction against Dr. Flagg. During the summer it is Judge Blatchford's custom to come to the city about every fortnight and hold court for a couple of days, and then leave for another fortnight. He came in town and held court on August 4th and 5th, but the motion in our case was not reached. His court then adjourned until August 24th, when he again held court on the 24th and 25th, and our motion was not reached. His court then adjourned to September 15th, and our motion was reached on September 17th. The counsel of the Celluloid Company was in court in attendance on the motion every day that Judge Blatchford held court, waiting for the motion to be reached, and it was not reached until September 17th, when, on account of the loss of the Celluloid Works by fire, and of Mr. Baldwin's absence in Europe, the court was asked to grant an adjournment for a few days, but Judge Blatchford said substantially that he had everything before him necessary to the decision of the motion, and that no adjournment was necessary, and he refused to grant the motion to adjourn. These facts were known to Mr. Bacon, for he was present, and yet in his circular he persists in falsely stating that the Celluloid Company sought delays. The enormous delay of which Mr. Bacon complains was from August 4th until September

265 17th, a period of forty-four days, and during that period no court was held for thirty-nine days. Mr. Bacon goes on to say that we interposed technical objections. We interposed just such defences and facts as were true and proper, but we suppose Mr. Bacon would have liked to prepare our case as well as his own—a method of his which will be pointed out as we proceed—but sooner or later he will have to come into court upon a case prepared by our own counsel, with proof put forward in our own way.

We now wish to call your attention to the plaintiffs' language upon moving for an injunction against celluloid in the Flagg case.

Their counsel said, "The Goodyear Dental Vulcanite Co. have no desire to present any new evidence in answer to the defendant's affidavits or arguments, and are entirely willing to rest the whole case upon the papers served, using these words in their strictest sense. * * * The question now presented is a pure question of law upon facts substantially undisputed. The question of law can be as well decided now as at the final hearing of this cause. * * * We repeat, therefore, that infringement is a mere question of law in this case, with every fact before the court known to either side which can by any possibility bear upon

its decision, and so far as the question of law is concerned there is no necessity for sending the case to final hearing. * * * And as it is a mere question of law its settlement now will be a settlement forever, so far as this court is concerned."

This was brave language, but the very moment Judge Blatchford denied their motion and in favor of cel'uloid Mr. Bacon hastened to back out of the case which by their language just quoted they had substantially agreed to regard as a final decision.

We wish to make this point clear. The suit was brought against Flagg for the use of cel'uloid. We admitted the fact. The plaintiffs asked for a preliminary injunction, which, after a full hearing of all the evidence, was denied; and when the decision was rendered they abandoned the whole suit, because, as Mr. Bacon says in his circular, "all these technical objections and petitions for constant delays convinced me that he (the defendant) sought only to delay the case, and showed me what I might expect in its future conduct."

We have just shown that there is not a word of truth in Mr. Bacon's statement as to delays. Let us follow the proceedings after the refusal of the injunction.

Judge Blatchford rendered his decision on the 7th of December, 1875. On the 23d of the same month they withdrew the suit, and
266 on the 8th January we urged them by letter to proceed and offered to reopen the case, and addressed their counsel as follows:

"We request, therefore, that you will consent to vacate the order of discontinuance, and proceed with the suit to a final hearing. * * * No time need be lost in amending the bill, as we consent that it may be amended in any way the complainants see fit. We waive all steps or notices which involve delay, and will stipulate to take the testimony and proceed to a final hearing at the earliest possible moment.

"If you are really desirous of a speedy determination of the questions involved in this suit as we are, we see nothing to prevent that end being reached at a very early day by your withdrawing your order of discontinuance and proceeding with the trial."

But no; Mr. Bacon, instead of being convinced, as he said he was, that we sought only to delay, was convinced that we were in earnest and intended to meet him fully prepared to break down his pretended monopoly, which the Dental Co. and himself have used without mercy. We have rights, and the dental profession has rights, and we propose to enforce them through the legitimate action of the courts.

After their refusal to go on with the Flagg suit—in which all the facts were fully raised—we hear of them in different parts of the country bringing suits (against the dentists using rubber, with which, strictly speaking, we have nothing to do); and after getting the case before a master on the question of rubber, then for the first time ringing in celluloid, upon which there has not been a word said in the moving papers, and by this means getting the "master" to pass upon the question of celluloid as an infringement of rubber. It does not require much knowledge even of the law to know that such a decision has no bearing upon the merits of the question at issue, but it does answer Mr. Bacon's immediate purpose of collecting from the party sued a license fee and using it also for intimidation of others. The dentists themselves are largely to blame for these results, as will more fully appear as we refer to particular cases, and which we hope will prevent a repetition of the Kibbee case in Michigan.

After Mr. Bacon's back-down in the Flagg case, we took the most speedy course left to us, and brought an action to restrain Mr. Bacon and

associates by injunction from bringing suits over the whole country, and to confine them to a suit upon the main question, "Is celluloid an infringement of the Cummings patent?"

We brought this suit in the United States circuit court, in the
267 city of New York, and gave the Goodyear Dental Vulcanite Company notice that we should apply on February 12th, 1876, for an injunction against them and Mr. Bacon to prevent them, as before stated, from harassing the dentists all over the country with suits and threats of suits. We were ready on that day to argue the motion, but the court was unable to hear us, and set the motion down for the 28th of February, when we shall be ready; and if Mr. Bacon and his company desire a decision of the question they can have it at that time.

We will now explain the situation of the suit brought by Mr. Bacon and his co., known as the Kibbee case, which is a sample of several which he has brought, but this will illustrate Mr. Bacon's tactics. After he had thrown up the Flagg case he goes off to the State of Michigan and brings a suit against Dr. Jared Kibbee, of Port Huron, not saying a word in his papers about celluloid. As Dr. Kibbee had used rubber in 1874 without a license, of course he had no defense, and so judgment was given against him by default for having used rubber. As soon as judgment was obtained and injunction granted, the matter was referred to a master of the court to report how much Dr. Kibbee must pay. Up to this point the proceedings were all regular, and then Dr. Kibbee was summoned before the master, and, in ignorance of his rights, induced by Mr. Bacon to consent that about four hundred pages of printed evidence which he had never seen should be admitted in this case. The master then reported against Dr. Kibbee, including celluloid; reference to which had been so ingeniously introduced by the papers referred to; and then it was that Dr. Kibbee for the first informed the Celluloid Co. of what had been done.

In other words, after judgment had been obtained against Kibbee, after Mr. Bacon had induced Kibbee to admit just such testimony as he, Bacon, wanted in the case, and after the master had made his report against Kibbee, then this company is notified of the case. Of course we can have nothing to do with such a case and can take no part in it. It is simply a sham case where both sides are conducted by Mr. Bacon. Dr. Kibbee did wrong in not notifying us, but there seems to be no doubt that he was grossly imposed upon.

A suit was brought in December, 1871, against Dr. Preterre, of this city, not for the use of celluloid but for the use of rubber. The Celluloid
Co. did not defend Dr. Preterre, nor have anything to do with the
268 defence of the suit, neither did it have any notice of the suit until the pleadings were all in and the testimony nearly all in. Just before the close of the suit the Goodyear Dental Vulcanite Co. introduced the matter of celluloid, and the counsel for Dr. Preterre called upon our Mr. Hyatt to give his testimony as to the manufacture of celluloid, and Mr. Baldwin was requested by Dr. Preterre's counsel to cross-examine Mr. H. B. Renwick; but we again state this company had nothing to do with the defence; but it is this case, so far as it relates to celluloid, that Mr. Bacon got Dr. Kibbee to stipulate should be introduced as part of its case; and upon which the "master" finding the record already admitted by the defendant made his report accordingly.

Other one-sided suits of this kind have been brought in different States, in which the same game has been played. One such has been brought against Dr. Hoppes of Baltimore, who after admitting the Preterre evi-

dence informed us of the fact. Another of the same kind was brought against Dr. Green, of Pittsburgh, Pa.

We will say nothing as to the good faith of parties, who, after allowing Mr. Bacon to complete his evidence and arrange the case to suit himself, then advise us, with the idea of our defending. We have already said in this circular that we prefer and intend to try the question of "celluloid vs. rubber" upon facts and testimony arranged by ourselves; and if dentists will keep their cases free from all complications, and will notify us or our counsel promptly, we will hold them harmless against damages for using celluloid. This is the co operation on the part of dentists asked for by us.

Mr. Bacon brought a number of suits in Baltimore for use of rubber; and as we were notified by some of the dentists that they knew celluloid was to be brought up before the master, we were present by counsel at the examination, and when they did introduce the subject we immediately objected, and they agreed not to raise the question as to celluloid, and the master so entered the fact. It will be clear to the comprehension of all that the master to whom is referred only the question before the court cannot pass upon the question of infringements of celluloid upon the Cummings patent; but if dentists foolishly admit testimony about which they know nothing, they not only do not help their rubber cases, but put themselves in damages for celluloid also.

We do not undertake the defence of vulcanite; but if any dentist using celluloid is sued, or if any motion is made to punish a dentist or hold him liable in any way for using celluloid, or if any dentist is
269 summoned before a master for using it, let him notify us at once, sending us any papers served on him, and not agree to admit any evidence in his case, or any record in any other case, on any pretence whatever, nor take any steps in it whatever until after giving us such notice, and hearing from us or our counsel. If such a suit is brought in Michigan let him send immediate notice to Messrs. Sprague & Hunt of Detroit, who are counsel for the Celluloid Co. If such suit is brought in Pennsylvania, notify Mr. Henry Baldwin, jr., Philadelphia; or if in New York, notify E. Luther Hamilton, 120 Broadway, New York; and if we can have control of the case from the outset we will assume the defence, confident of defeating Mr. Bacon again as we did in the Flagg case.

In concluding this circular we would call attention to the fact that we made celluloid dental plates in 1870, and from that to the present time. The sale of these plates being known to Mr. Bacon, why did he not bring his suit at an earlier day? He has had five years to test the case of infringement, and yet, in his circular, he talks of delay on our part.

He asked for an injunction against Dr. Wolf, of Washington, in 1872, for the use of celluloid. The judge granted the injunction as to the rubber, but refused as to celluloid, but gave the plaintiff permission to amend his complaint, which was the end of it.

Again, Mr. Bacon waits until 1875, and then commences his Flagg case (referred to in this circular). The use of celluloid is admitted, and again Mr. Bacon withdraws, and now we have taken the initiative, and as plaintiff bring them into court for a decision which will relieve the dental profession from all further trouble as regards celluloid, if the court will give us the relief asked for, and we believe it will, for no fairer case in equity has ever been presented.

CELLULOID MANUF'G COMPANY.
MARSHAL LEFFERTS, *President.*

N. B.—March 2, 1876. Circumstances have delayed the issue of this circular, and we are enabled thereby to state that the court, for its own convenience, on the 28th ult., again adjourned the hearing of our motion for an injunction against the Dental Vulcanite Co. until the 10th inst., when we hope it will be reached. We wish it to be distinctly understood that if the court, upon a hearing, refuse us a preliminary injunction, we shall still persevere with our case for a trial upon its merits.

270 (Counsel for complainants offer in evidence a certified copy from the bound volumes of the library of the U. S. Patent Office of the specification in the matter of English letters patent granted James A. Cutting, dated July 26, 1854, No. 1638, and the same is marked Complainants' Exhibit O, J. G. S., Examiner.)

Complainants' Exhibit O.—J. G. S., Examiner.

DEPARTMENT OF THE INTERIOR.

U. S. Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the bound volumes of the library of this office of the specification in the matter of English letters patent granted James A. Cutting, dated July 26th, 1854; No. 1638.

In testimony whereof I, W. H. Doolittle, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this twenty-ninth day of August, in the year of our Lord one thousand eight hundred and seventy-six, and of the Independence of the United States the one hundred and first.

W. H. DOOLITTLE,
Acting Commissioner.

Specification in pursuance of the conditions of the letters patent filed by the said James A. Cutting in the Great Seal Patent Office, on the 22nd January, 1855.

To all to whom these presents shall come, I, James A. Cutting, of Boston, in the United States of America, photographer, send greeting:

Whereas Her Most Excellent Majesty Queen Victoria, by her letters patent, bearing date the twenty-sixth day of July, in the year of our Lord one thousand eight hundred and fifty-four, in the eighteenth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said James A. Cutting, Her special license that I, the said James A. Cutting, my executors, administrators, and assigns, or such others as I, the said James A. Cutting, my executors, adminis-

271 trators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter, during the term therein expressed, should and lawfully might make, use, exercise and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an invention for "an improved process of taking photographic pictures upon glass, and also of beautifying and preserving the same," upon the condition (amongst others) that I, the said James A. Cutting, by an instrument in writing under my hand and seal, should particularly describe and ascertain the nature of the said invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within

six calender months next and immediately after the date of the said letters patent:

Now know ye, that I, the said James A. Cutting, do hereby declare the nature of my said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement (that is to say):

This invention consists in an improved process of taking photographic pictures upon glass, and also of beautifying and preserving the same, which process I have styled "ambrotype." My improved process has reference to the art of taking pictures photographically on a film of collodion upon the surface of a sheet of glass, the collodion being suitably prepared for the purpose. By the use of the said process, the beauty and permanency of such pictures are greatly increased, and I have on this account styled the process "ambrotype," from the Greek word ambrolos, immortal.

The first part of my invention consists in the use of alcohol, for the purpose of depriving the gun cotton, of which the collodion is made, of its moisture after it has been washed, to free it from the acids used in its manufacture.

It has been found that where gun cotton has been exposed to the action of the atmosphere, for the purpose of drying it, the sensitiveness of the collodion prepared from it is sensibly diminished. By the use of alcohol it may be deprived of its moisture after being washed, without exposure to the air, and without the consequent deterioration of its sensitiveness. This part of my process I conduct as follows: So soon as the cotton has been sufficiently exposed to the acids and has been thoroughly washed, it is plunged into strong alcohol, which effectually deprives it of the water which it contains, without exposing it to
272 the atmosphere for the purpose. From this alcohol it is taken immediately to the mixture in which it is to be dissolved for the purpose of forming the collodion. This mixture consists of 10 parts of sulphuric æther and 6 of alcohol or thereabouts. The collodion thus formed is allowed to remain until it has settled perfectly clear, which usually requires about 24 hours. It is then decanted, and to every pint is added 80 grains of iodide of potassium dissolved in alcohol. It is then well shaken and 32 grains of refined gum camphor is added to each pint of the collodion, and after it has again settled it is fit for use. The object of the camphor is to increase the vigor and distinctiveness of delineation of the positive pictures, and particularly of the half tints. It also greatly increases the beauty of the picture, by giving a fineness of deposit not heretofore attained by any other means. The use of the gum camphor, in the manner above described, forms the second branch of my invention. The collodion is then applied to the surface of the glass in the following manner:

The plate of glass being held horizontally, a portion of the collodion is poured upon it, and it is then inclined in different directions, so as to cause the collodion to flow over its whole surface, upon which it forms a colorless transparent film; the excess of collodion is then allowed to run off, and the glass being still held horizontally, is inclined to one side and the other, until the collodion becomes partially thickened or set. When this has taken place, and before it is dry, it is rinsed in a solution of crystalized nitrate of silver, of a strength of 40 grains to the ounce of water; the film is thus impregnated in the iodide of silver, and after remaining in this bath a sufficient length of time for the æther to escape from the collodion, the plate is ready to be placed in the camera. After being exposed a sufficient length of time in the camera, it is taken to a

dark room, where the latest picture is developed, by the application of a solution of protosulphite of iron, acetic acid, and nitric acid, in about the following proportions:

1 quart of soft water, 1 ounce protosulphite of iron, 32 drachms No. 8 acetic acid, 1 drachm nitric acid. These exact proportions are not rigid, but I have found them to be sufficient for the purpose of developing the picture. After this is accomplished it is washed in clean soft water, and then the remaining iodide of silver is dissolved from the collodion film by a solution of hyposulphite of soda, after which the picture is entirely cleansed of the hyposulphite solution by washing
273 as before in soft water. The picture is then dried, either in the open air or by the aid of a gentle heat, and the process is completed.

To permanently improve the beauty of the pictures, and to deprive them of a bluish, hazy, indistinct look, is the object of my third improvement; which consists in the application of a coating of balsam of fir to the surface of the glass upon which the picture is made, the *the* balsam being confined to the picture plate by a secondary plate of glass, which is applied to the picture plate in a manner which will now be described, and which hermetically seals up the picture and protects it from every and any injury not sufficient to fracture the glasses themselves. This part of the process will now be described.

A second plate of glass is prepared of the same size as that which carries the picture, and is thoroughly cleansed; the picture plate is then held horizontally, ... the picture side uppermost. The balsam is then applied in a line along one edge of the glass, and one edge of the secondary plate is then applied to the edge of the first, which contains the balsam. The two plates are then pressed gradually together, by which the balsam is caused to flow entirely across the picture towards the opposite edge, and the air is effectually excluded from between the plates. The superabundent balsam is then removed by pressing the glasses together, and a thin coating of it only is left upon the surface of the picture. The beauty and distinctness of the pictures are greatly enhanced by this application, the finer lines as well as the dark portions and shadows being rendered far more distinct, and the most minute delineations being brought out and made visible, while the application of the second plate of glass secures the whole from the action of air, moisture, and dust.

What I claim as my invention, and desire to secure by letters patent, is—

1st. The method herein described of depriving the gun cotton of its moisture by the use of alcohol, whereby the sensitiveness of the collodion prepared therefrom is preserved unimpaired.

2d. The use of gum camphor in the preparation of collodion for the purpose set forth.

3d. I am aware of the previous use of balsam for the purpose of cementing together lenses, and also of securing microscopic objects, and I therefore lay claim to no such use; but what I do claim and desire to secure by letters patent, is the application of the balsam to the surface of photographic pictures upon glass, in combination with
274 the method herein described of protecting and securing the same by means of the additional plate of glass, as set forth.

In witness whereof I, the said James A. Cutting, have hereunto set

my hand and seal this 22d day of December, in the year of our Lord 1854.

[L. S.] J. A. CUTTING.

Exd.—L. P. H.

HENRY B. OSGOOD.

(Counsel for defendant objects to the offer and to the exhibit as incompetent, being an enlargement and reopening of complainants' case in chief, and not in rebuttal of anything offered by defendants in their proof.)

Also, a certified copy from the bound volumes of the library of the U. S. Patent Office of the specifications in the matter of English letters patent granted Alexander Parkes, dated October 22, 1855, No. 2359, and the same is marked Complainants' Exhibit P., J. G. S., Examiner.

Complainants' Exhibit P.—J. G. S., Examiner.

The U. S. Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the bound volumes of the library of this office of the specification in the matter of English letters patent granted Alexander Parkes, dated October 22d, 1855, No. 2359, for manufacture of elastic and adhesive compounds.

In testimony whereof I, W. H. Doolittle, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this twenty-fourth day of June, in the year of our Lord one thousand eight hundred and seventy-six, and of the Independence of the United States the one hundredth.

W. H. DOOLITTLE,
Acting Commissioner.

A. D. 1855. No. 2359.

275 MANUFACTURE OF ELASTIC AND ADHESIVE COMPOUNDS.

Letters patent to Alexander Parkes, of Burry Port, Llanelly, county of Carmarthen, South Wales, for the invention of "Certain preparations of oils for and solutions used when waterproofing, and for the manufacture of various articles by the use of such compounds." Sealed the 25th January, 1856, and dated the 22d October, 1855.

Provisional specification left by the said Alexander Parkes at the office of the Commissioner of Patents, with his petition on the 22d October, 1855.

I, Alexander Parkes, of Burry Port, Llanelly, county of Carmarthen, South Wales, do hereby declare the nature of the invention for "Certain preparations of oils for and solutions used when waterproffing, and for the manufacture of various articles by the use of such compounds," to be as follows:

My improvements consist in the treatment of oils, by the action of chloride of sulphur, alone or with other substances, so as to produce an elastic, solid, or adhesive compound; and in the use of gun-cotton or other similar compounds in pyroxylic spirit (wood naptha) or other sol-

vents of such compounds, alone or compounded with gums, resins, or other substances.

The above preparations and solutions I use for waterproofing and manufacturing various articles having properties analogous to those made from India-rubber or gutta-percha.

Specification in pursuance of the conditions of the letters patent filed by the said Alexander Parkes in the Great Seal Patent Office on the 17th April, 1856.

To *to* all to whom these presents shall come:

I, Alexander Parkes, of Burry Port, Llanelly, county of Carmarthen, South Wales, send greeting:

Whereas her most excellent Majesty Queen Victoria, by her letters patent, bearing date the twenty-second day of October, in the year of our Lord one thousand eight hundred and fifty-five, in the nineteenth year of her reign, did, for herself, her heirs and successors, give
276 and grant unto me, the said Alexander Parkes, her special license that I, the said Alexander Parkes, my executors, administrators, and assigns, or such others as I, the said Alexander Parkes, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time, and at all times thereafter during the term therein expressed, should, and lawfully might, make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an invention for "Certain preparations of oils for and solutions used when waterproofing, and for the manufacture of various articles by the use of such compounds," upon the condition (amongst others) that I, the said Alexander Parkes, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said letters patent. Now know ye, that I, the said Alexander Parkes, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say:

The first part of my invention relates to the treatment or preparation of oils, so as to produce a change in the oil or compound by the use of chloride of sulphur. The effect of the action of chloride of sulphur on oils is to render them solid, insoluble in mineral naphtha, sulphuret of carbon, or other agents by which oils in their simple state are acted upon.

The oils so changed have very much the character of vulcanized or *or* converted India-rubber, and may be used for a variety of purposes; and I find that oils with India-rubber or gutta-percha may be changed or converted, as above described, by the use of chloride of sulphur, and such compounds are as permanent as vulcanized rubber alone. I mention this fact, as it is well known that oils have a decomposing effect on India-rubber alone. In carrying out this part of my invention, I use linseed, rape, castor oil, or other oils that are acted upon in a similar way by chloride of sulphur, and I prefer to use them in a well-refined state, alone or combined with other substances.

If I desire to prepare a solid substance, I take 100 lbs. of either of the

above oils or mixtures, and from 50 to 80 lbs. of crystalized
277 chloride of sulphur, and incorporate them well together by grinding or other means, and place them in a mould of metal or earthenware and submit the contents to a heat of from 200° to 250° Fahrenheit for three hours, and if the change is not sufficiently effected I increase the temperature to 270° or 300° until the desired change is brought about; this will be known by the oil or compound becoming solid and elastic, and non-adhesive.

If I desire to prepare a solution I proceed as follows: I take 100 lbs. of oil or mixture, and from 10 to 15 lbs. of liquid chloride of sulphur dissolved in 20 to 30 lbs. mineral nap'tha, benzole, or sulphuret of carbon. I first mix the chloride of sulphur and nap'tha or other solvent, then add the oils, and quickly agitate. If the mixture is to be used for sheets, I pour it out onto glass tables or moulds, plain or ornamental; in a short time it will gelatinize or set so that it can be removed, when it will be found highly elastic, and if the mould was an ornamental one the impression on the substance will be very sharp. Should it contain any free chloride of sulphur, I prefer to wash it out, or neutralize it by an akaline or other solution. The solution as above prepared may be spread upon cloth, or worked up with fibrous or other substances, to produce various effects, according to the use for which it is required. When I desire to combine India rubber or gutta-percha with the oils, I take 100 lbs. of the ordinary solution of India rubber or gutta-percha, or mixtures of them, dissolved in any of the well-known solvents, and I add from 50 to 100 lbs. of any of the oils or mixtures, as before explained; 15 to 25 lbs. chloride of sulphur liquid dissolved in 20 to 30 lbs. mineral naphtha, benzole, or sulphuret of carbon. I mix by agitating the India rubber or gutta-percha with the oils, and then adding the changing agent, viz, the chloride of sulphur in its solvent, and again agitate as rapidly as possible. This solution may be poured out, cast, or used as a coating to other substances, or mixed as above explained; but all the operations must be performed quickly, as the change takes place with more or less rapidity, according to the quantity of chloride or sulphur used. The substance thus produced is highly elastic and extensible, and will be found useful for a variety of purposes to which India rubber and gutta-percha are now applied, and it may be ground up with India rubber or gutta-percha, and vulcanized in the usual man'er.

The second part of my invention relates to the use of solutions of gun cotton or other similar compounds. It is well known that a
278 solution of gun cotton has been used principally as a photographic agent, and in surgical operations, but my object is to employ collodion or its compounds for manufacturing purposes generally. The method of dissolving gun cotton being well known, I do not think it necessary to give proportions, but simply to say that when I use a thin solution, I add more of either of the solvents to the gun cotton, and if I require a stiff preparation, less of the solvent is to be used. I dissolve gun cotton or other similar compound in vegetable naphtha, alcohol, methylated or other ethers, or other solvents of gun cotton. For a transparent and colorless substance I use the solution of gun cotton alone, or with gums or resins that will set transparent with it, and this is applicable as a coating to silk, tinsel articles, other textile fabrics, sewing cotton, thread, worsted, string, felted goods, leather, plaster, or wood, rendering them waterproof, and from its freedom from color it does not impair the beauty or injure the color or texture of the most delicate fabrics, and I find silks and other articles thus treated preserve

the brightness of their color for a much longer time than when not so prepared. I also use coloring agents or metallic bronzes with solutions of gun cotton for waterproofing and coating other articles, such as paper, &c., and by the use of such colored solutions I obtain many pleasing effects, suitable for a variety of purposes; and I also use gums or resins, or stearine in solutions of gun cotton for the same purposes. When manufacturing sheets from solutions or preparations of gun cotton alone, or combined with India rubber, gutta-percha, or other substances, and whether colored or not, I prefer to use a thick solution, and with spreading machinery, similar to that used in the manufacture of India rubber, I spread the preparation in the well-known manner until I obtain the desired thickness. The solvent may be recovered, if required, by condensing it as it passes off while the sheets are drying at a temperature of from 100 to 200° Fahrenheit. These sheets may be transparent and colorless, or they may be colored or combined with a variety of substances to produce different effects suitable for bookbinding, button manufacture, and other applications where a hard, strong, brilliant material is required; or flexible sheets may be made by varying the proportions of the substances used. Or I make sheets or other forms by using as little of the solvent of gun cotton as possible, so as to obtain a stiff plastic compound, which may be colored or combined with other substances, and this I work up with any suitable machinery until well blended or incorporated, when it may be rolled or pressed
279 into sheets or other forms; when dry it is very hard and waterproof.

I also manufacture sheets or other forms of calico, linen, lace, or paper that have been treated with acids in the manner employed in preparing gun cotton. The sheets or other forms, when well washed, free of acids, are dried, and are then soluble in ether; but instead of completely dissolving them, I only use such a proportion of solvent as will penetrate but not disintegrate them; in fact, the sheet can be dipped into a bath of the solvent, and when sufficiently penetrated and acted on, taken out and dried at a temperature of 80° to 150° Fahrenheit. These sheets when prepared from calico or linen will be useful for many purposes, as they are waterproof and have a silky, shining appearance, and may be white, or colored by dying or other means, and any design may be given thereto before acted on by the naphtha or other solvent; or they may be dipped in a bath of colored collodion after they have been partially acted on by the naphtha or other solvent, or a variety of colors may be applied to the same sheet so as to produce designs which will be permanent and waterproof, or the sheets may be ornamented by pressure in dies or between rollers. I also make sheets plain or colored by pouring the solution onto glass plates, plain or etched, and if required, several coats of collodion or dissimilar substances may be used to strengthen the sheet, such as a solution of gutta-percha purified, as described in my patent of 25th day of March, 1846; one coat being allowed to dry before the other is applied. Other forms or ornamental surfaces I make by dipping a model into a bath of the collodion, whether colored or not, and whether strengthened or not, as above described; these must be dried with care at a low temperature or they may blister; or I cast a solution of gun cotton alone or with other substances into moulds, and when dry a beautifully sharp impression of the mould will be obtained. I also manufacture thick sheets of a compound nature by cementing several sheets together, which may be of dissimilar substances, thus a sheet of collodion, then a sheet of cloth, then another sheet of collodion, &c., or I saturate felted goods with my preparation

of gun cotton. I also prepare colored solutions of collodion, and in this state they may be sold for a variety of purposes.

In conclusion I wish to remark that I prefer to use with the preparations of gun cotton substances of a less inflammable nature to prevent or neutralize the ready combustibility of that substance. I find a
280 great variety of substances can be used for this purpose, but I shall only name a few of those I have found most useful: Phosphate of ammmonia and magnesia, iodide of cadmium, per-iodide of mercury, oxalate of lime, talc, alum.

In witness whereof I, the said Alexander Parkes, have hereunto set my hand and seal this sixteenth day of April, in the year of our Lord one thousand eight hundred and fifty-six.

[L. S.] ALEXANDER PARKES.

Witness:
THOS. RODERICK,
Pembury, South Wales.

(Counsel for defendant repeats the last stated objection in respect to this offer and exhibit.)

Also certified copy from the bound volumes of the library of the U. S. Patent Office, of the specification in the matter of English letters patent granted Stephen Barnwell and Alexander Rollason, dated Sept. 15, 1860, No. 2249, and the same is marked complainants' Exhibit A, J. G. S., Examiner.

Complainants' Exhibit Q.—J. G. S., Examiner.

The U. S. Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the bound volumes of the library of this office of the specification in the matter of the English letters patent granted Stephen Barnwell and Alexander Rollason, dated September 15th, 1860, No. 2249, for "Imp't in combining and mixing certain solutions of p'roxyline with animal, mineral and vegetable substances."

In testimony whereof I, Ellis Spear, Acting Commisssioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this second day of December, in the year of our Lord one thousand eight hundred and seventy-five, and of the Independence of the United States the one-hundredth.

[SEAL.] ELLIS SPEAR,
Acting Commissioner.

281 Specification in pursuance of the conditions of the letters patent filed by the said Stephen Barnwell and Alexander Rollason in the Great Seal Patent Office on the 15th March, 1861.

To all to whom these presents shall come, we, Stephen Barnwell, of Coventry, in the county of Warwick, manufacturer, and Alexander Rollason, of the same place, chemist, send, greeting:

Whereas her most excellent Majesty Queen Victoria, by her letters patent, bearing date the fifteenth day of September, in the year of our Lord one thousand eight hundred and sixty, in the twenty-fourth year

of her reign, did, for herself, her heirs, and successors, give and grant unto us, the said Stephen Barnwell and Alexander Rollason, her special license that we, the said Stephen Barnwell and Alexander Rollason, our executors, administrators, and assigns, or such others as we, the said Stephen Barnwell and Alexander Rollason, our executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should, and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an invention for "improvements in combining and mixing certain solutions of pyroxylene with animal, mineral, and vegetable substances, by which its quality is altered in such manner as to produce hard, resistent, adhesive, plastic, or resilient compounds, and articles unalterable in their nature and varied in color, which said compounds, in a state of solution, may also be advantageously employed as paints or varnish," upon the condition, amongst others, that we, the said Stephen Barnwell and Alexander Rollason, by an instrument in writing under our hands and seals, should particularly describe and ascertain the nature of the said invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calender months next and immediately after the date of the said letters patent:

Now know ye that we, the said Stephen Barnwell and Alexander Rollason, do hereby declare the nature of our said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, that is to say:

Our invention consists in dissolving pyroxylene in any of its known solvents, and adding thereto oils, animal, vegetable, or mineral, varying in their nature and their action, with pyroxylene, selecting any of these to suit any particular views we may entertain relative to the subsequent use of the compound. To this we add, if desirable, gums or resins, and also oxidisable salts, such as oxide of manganese or oxide of copper, as coloring agents. Any other suitable coloring may likewise be employed. Other mineral substances, such as chloride of calcium and iodide of cadmium, are useful when articles of an uninflammable nature are to be produced. Animal matters, in the shape of glue, gelatine, or wool flock, or of nature similar to these, we also find for the purpose of strengthening the compound. The material resulting from these combinations is applicable to the manufacture of many solid, hollow, or tubular articles that have hitherto been made of glass, china, metal, wood, India rubber, and such like materials, and the treatment of the compound for the purpose of making such articles would vary with the nature of the article to be produced. For instance, buttons may be made either by stamping them from a solid sheet of the new material, after the manner of horn-button making, or they may be shaped in moulds whilst the material is in a plastic or semi-fluid state. So with drinking cups, bowls, and flasks, which may be made by coating either the inside or outside of glass or polished metal moulds with repeated layers of the new compound in a state of solution, or by the mode by which pressed glass is made; the material being used in a plastic state, in which state also it would be found very useful for employment in moulding or taking fine casts, such as those required for purposes of dentistry and modeling for jewellers, goldsmiths, and other industries needing sharp, smooth, and indestructible models or moulds. It may also be employed for making tubes and instruments for surgical and hyg'enic uses. Cups, bowls, tubes, and such like things, may also

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be made by coating textile fabrics with our solutions, and then cutting such fabric out into the desired shape, and afterwards cementing the edges, or the raw material of such textile fabrics may be saturated with our solution, and from which various articles may be produced.

These are but a few of its applications. In the solid form in sheets it would be useful for bookbinders and fancy box makers, for making collapsible tubes for colors, and for all the purposes for which collapsible tubes are used; and as it can be rendered adhesive by some of the modifications already mentioned in the manufacture, its applications in this form would be multifarious.

In a state of solution, its uses would be as a vehicle for pigments, either oil or water, or as varnish for pictures, painting, prints, or
283 papers, a lacquer or wash for gilded or plated wares, whether on wood or metal, to protect them from injury; as a coating for hat bodies, for boots, shoes, and leather in general; lining or covering plastic casts, pens, telegraph wire, and all delicate parts of machinery requiring protection.

We will now proceed to describe the process by which we combine pyroxylene with the various substances, animal, vegetable, and mineral, before named, so as to obtain a complete amalgamation between them, and thereby produce compound materials, capable of being employed for many useful arts, to be hereinafter mentioned. And, firstly, with reference to the pyroxylene itself and its manufacture, which has hitherto been effected by a difficult, uncertain, and expensive process, arising from the fact that the mixed acids, nitric and sulphuric, used in converting the fibres into pyroxylene, could not be employed more than twice in the same operation, as they would be found to hold either a considerable quantity of pyroxylene or converted fibre in suspension, or that the nitrogen was partially exhausted, or from both these evils together; consequently, after twice using, these acids were of no further service for such a purpose. With a view, therefore, of utilizing these waste acids, we employ as our fibre, and in place of cotton (which we can employ, although we prefer the following), common rags of any description, plain or colored, and having submitted them to the action of the acids in the same manner as cotton, we find that they do not become disintegrated as the cotton would, and, consequently, after twenty or twenty-four hours' contact with the acids, the acids may be drawn off, free from any suspended pyroxylene. The partially exhausted acids are then put in suitable air-tight vessels until a sufficient quantity may have been reserved. The bulk is then to be thoroughly and equally mixed and boiled, then analyzed, and the loss of strength ascertained; after which the equivalent must be supplied by the introduction of very strong fresh acids, in the requisite proportions, by which they will be restored to their original strength, when they may be re used. The re use and renewal may be repeated as often as may be found desirable. This is the description of pyroxylene we prefer to employ in our subsequent process of manufacturing compounds of pyroxylene into various useful articles, though any description of pyroxylene will also answer these ends, but, as before stated, at greater cost.

We also obtain a very useful description of the same article by submitting fibrous and other matters containing cellulose to the
284 action of mixed acids of such modified strength and temperature that they will be only partly converted into pyroxylene, and, consequently, they will be only partly soluble in the solvents of pyroxylene. This forms a kind of half-stuff. But in all cases both the pyroxylene

and the partially converted fibre or half-stuff must be freed from acids and dried before advancing to the further processes.

As to the ingredients: We compound with the pyroxylene, which compounding or amalgamation takes place in some instances before, and in others subsequent to the pyroxylene having been submitted to the action of its solvents, varying as the nature of any peculiar manufacture may demand. They are as follows: Assuming that we desireto make paper or other like article of dry pyroxylene, and whether it be destined to be afterwards dissolved, or to be employed in its state of paper, we reduce the pyroxylene to pulp and manufacture it into paper in the ordinary way, and by the well-known means, mixing with the pulp, if we choose, and whilst in process of manufacture, common paper pulp, or any other vegetable, mineral, or mineral product free from water, and capable of imparting to the mass strength, weight, or durability, such, for instance, as leather shavings, animal hair, cocoanut fibre, kaolin, coke-dust.

In producing compound solutions of pyroxylene with other ingredients, to be employed in the manufacture of solid articles, or in a fluid or semi fluid state, as it would require to be for the purpose of spreading upon surfaces, coating, or cementing, we mix and intimately combine with the solution of pyroxylene, either individually or collectively, in character and proportion to be governed by the special requirements of each case:

Oils.—Essential, animal, vegetable, or mineral.

Gums.—Resins, balsams, tar, pitch, bitumen, cements, wax, tallow, and grease; India rubber and gutta-percha; ivory and bone dust; powdered bark, farinaceous and amylaceous substances, starch, and dextrine.

Vegetable or mineral pigments and bronzes may be introduced as coloring agents, care being taken that everything employed in the compound be free from water. The solution of pyroxylene will, from its adhesive nature, combine freely with almost any foreign matter, and the compounds thus formed may be rendered available for a great variety of purposes, to be hereinafter more particularly specified.

We also use chloroform and bisulphide of carbon for the purpose of dissolving India rubber and gutta-percha, being the best solvents
285 of these gums, to be afterwards mixed with our compound. Ether and alcohol, for thinning or reducing the strength of the compound. All anhydrous basic salts that may be soluble, or that will in any way combine with the pyroxylene, iodide of potassium and cadmium, oxides of metal capable of imparting color or density; iron combined with oxyde of zinc, producing red; iron and chromium for violets; copper and oxyde of zinc for greys; cobalt for greens; nickel for yellow and olive, and manganese for yellows; kaolin, with oxyde of zinc and a cobalt, to give a blue green.

We also apply certain materials to or upon our compound independently of those which we mix or incorporate with it, and these materials applied to it may be so applied either whilst our composition is in course of drying or after it is well dried, and they consist for the most part of ingredients which would not combine with our compound material without destroying its cohesive and homogeneous character, unless employed in very small proportions. These are all descriptions of varnishes, paint, tar, pitch, bitumen, resins, balsams, soaps, stearine, tallow, grease; these separately or combined; gelatine, isinglass, gums, starch, dextrine, gluten, albumen, amylaceous, farinaceous, and such like substances, whether soluble or insoluble in water; phosphate, borate, tungstate,

and silicate of soda and potash, and other substances that would only mechanically mix with our composition such as sulphur, kaolin, ground flint, powdered gums and resins, bone dust, waste leather and almost all similar substances free from water, and which our composition would agglomerate or cause to adhere. Again, glycerine and other like ingredients, the menstruum of which is water, most of which when laid upon our composition and dried would adhere to it firmly, and would impart to it either strength, substance, or uninflammability, and would consequently be very useful. Flocks such as are used in the manufacture of paper-hangings, bronze powders, and gold and silver leaf may also be applied for purposes of ornamentation, and these delicate parts may also be completely protected from damage by the simple application of another coat of our composition in solution.

With respect to the more solid articles into which our compound may be worked up, such as all materials used in the manufacture or making up of garments, such as buttons, boxes, or wrappers for steel toys, needles, pens, jewelry, and for fancy goods; articles capable of holding fluids, such as bottles and flasks, or grease, such as pots for oint-
286 ments and perfumery; for surgical uses such as nippers, tubes, splints, and skins; articles for which moulds or impressions are required, such as type seals, medals, duplicates of engraved plates, or to take the place of engravings, wood, metal, or plaster for printers' use; for all purpose of dentistry requiring indestructible moulds or models; hollow wares, such as cups, bowls, flasks, and tubes for upholsterers' and carvers' and gilders' uses, for picture frames, parts of furniture, imitations of wood and leather, artificial coral for jewellers; for boot and shoe-makers to produce both soles and uppers. We also make toys, artificial leaves and flowers, and many fancy articles usually made in metal, wood, bone, glass, ivory, china, and earthen ware, india-rubber, gutta-percha, plaster, and wax, and our process of making such articles is (when the nature of the article will admit of such treatment) by employing moulds or dies of any suitable material for which our composition has no affinity or to which it will not adhere, and casting or pressing out the article from composition in a plastic, semi-fluid, or fluid state.

If in a plastic state, then it may be treated as a paste; if in a fluid condition, it may be poured or brushed upon the mould, or the mould may be immersed in it until by adding coat upon coat sufficient thickness has been acquired, and as each coat attains the desired condition, that is to say, dry or partially so, according to circumstances, we can introduce a coat or sheet of any material, to make up thickness and inflexibility, such as varnish, starch, gelatine, afterwards proceeding to apply thereupon an additional coat or coats of our compound, but if flexibility be desired, we should avoid the use of any of these intermediate materials.

Another mode in which we can manufacture buttons and other solid forms is by stamping, pressing, or cutting them out of a sheet of the material previously formed into a sheet by repeated coatings or layers of the compound in solution, in which state we also employ it for coating and insulating telegraph wires, whether such wires have been already protected by covering of any kind, or upon the bare metal. The solution is also a complete protective coating for percussion caps. A film formed on the inside or a thin washer placed there, thoroughly and effectually preserves the charge of detonating mixture from damp.

In the manufacture of gunpowder we find pyroxylene extremely useful, and this forms one of the most important applications of our inven-

tion. We take dry p'roxylene and reduce it to powder, in which
287 state we employ it in place of or in conjunction with charcoal in the manufacture of a gunpowder. This, from the highly explosive character of the material, adds very much to the strength of the gunpowder, whilst it avoids, to a very considerable extent, if not altogether the residu'm that remains after the discharge of ordinary gunpowder, and at the same time is free from the danger attending the use of gun cotton.

We will now enumerate a few of the uses to which these compounds of p'roxylene, in a state of solution, may be supplied, in which condition they form an excellent coating or dressing for all descriptions of textile woven fabrics, oiled or painted cloths, silks or paper, manufactured india-rubber and gutta-percha goods, cotton, thread, string, rope, and similar manufactures of silk, cotton, flax or wool; as a varnish for paper, prints, drawings, felted goods, leather goods, and wax in sheets; for metal work, wood and composition, gilded painted or polished; as a preservative of stone, bricks, or plaster from the action of the atmosphere.

In making oiled cloths, or in other similar manufactures, which in the course of making might require artificial heat in drying, we should employ a composition containing in addition to dissolved pyroxylene, some drying oil, such as linseed, nut, or poppy, and upon the cloth coated with this composition, when dry, we should either paint or varnish, and allow this to dry, and then cover it with another coat of our solution, repeating these operations until the desired effect and substance had been attained. If the article in course of manufacture be required to be inodorous, or to be perfumed, and does not require artificial heat for drying, we should mix with the solution of p'roxylene, olive, almond, castor, or other similar oils, the smell of which would evaporate in drying, or could be destroyed by the admixture of perfumes. When we desire to produce a very firm, stiff coat upon any surface, we introduce into the composition, gums, resin, balsams, and other similar ingredients having a tendency to harden the coating. In dressing silks and other like fabrics we prefer to use the solution in a very limpid state, varying the ingredients and the proportions of the same, according to the requirements of the case, and as to whether the article was to be dried by artificial heat or spontaneously.

In making varnishes, lacquers, or cements, also, the solution may be mixed with a view to drying by heat or spontaneously. These solutions
288 used as dressing or coating for surfaces may be applied either by the brush, the spreading knife, by dipping, or from polished surfaces. For instance, strong textile or woven fabrics, we should prepare by laying on the composition with a spreader; any article that could best be saturated we should dip in a bath of the solution; thin fabrics, such as gauze or muslin, would be best coated by means of polished surfaces of metal or glass, upon which the solution being poured until the surface is covered, the fabric is laid upon it and becomes attached to it, and the whole is removed from the polished surface in one united fabric, or by laying the thin fabric upon the polished surface, and spreading the solution evenly over it, by which means the fabric becomes saturated in manner referred to in the specification of a former patent granted to Alexander Rollason, and dated December eleventh, one thousand eight hundred and fifty-eight, or we can adopt both these processes with the same material. The same method of dressing or coating would be used upon any material that had been previously covered by some other means, such as oiled and painted cloths, silks, papers,

fabrics of paper pulp, now made into collars and cuffs, vegetable parchment and other like manufactures, and these we can treat either upon the side already coated, or upon the reverse side, and by the employment of our composition two or more surfaces or sheets of any of the fabrics enumerated or of similar description thereto, may be cemented together, and thus very strong and tenacious materials may be made suitable for uses, such as machine bands, harness, and tubing.

The uses or applications of the various description of material that may be manufactured under this, our, invention, are far too numerous to be particularly classified, the following are but a few of them:

Articles of apparel, of every kind, umbrellas, parasols, cart covers, tents, sails, machine bands, straps, belts, tubes, harness for bookbinder's uses, both as a cement, and also as a material for the covers of books; air and water-bed and cushion covers; sponge and other bags; cups, bowls, basins, and jugs; to protect cartridges, caps, and projectiles from damp; for bottles, boxes, and jars; for surgical and dentistical purposes as well as for the manufacture of sticking plasters and surgical instruments, and for any other purpose analogous to or of a kindred nature to any of these; in a pulverized state as a substitute for charcoal in the manufacture of gunpowder. In a state of varnish or lacquer it may be used for wood, papier-mache, leather, metal, bricks, stone, plaster, glass, china, earthenware, bone, ivory, india-rubber, 289 gutta-percha, gelatine, and all other articles made of or similar to these, or of a nature akin to these. For rendering impervious to the action of the atmosphere all articles desired to be preserved; for finishing and stiffening every description of paper and pasteboard; as a varnish for oils and water-color paintings, and a vehicle for pigments; for sheathing for ships, and roofing; for saturating articles or goods requiring it; and, generally, for any and all purposes of a like nature to those we have already enumerated. As to the proportions of the several ingredients employed in carrying out the various branches of our invention, and the manipulations required to bring the same to a successful issue, these must be left to the judgment and skill of the operator; they vary as the nature of the article to be produced, and practice alone can determine the course to be followed in any case.

Any ordinary practitioner acquainted with the nature and properties of pyroxylene will readily understand this; he will, at the same time, find no difficulty in working out the invention.

Having now described the nature of our said invention, and the manner in which the same is to be performed, we wish it understood that we do not confine ourselves to the precise details herein given, as many variations of the same might be suggested without departing from the spirit of our invention; but that which we claim, and desire to have secured to us by the hereinbefore in part recited letters patent, is—

Firstly, the several improvements in combining and mixing certain solutions of pyroxylene with animal, mineral and vegetable substances, by which its quality is altered in such a manner as to produce hard, resistent, adhesive, plastic or resilient compounds and articles unalterable in their nature and varied in color, which said compounds in a state of solution may also be advantageously employed as paints or varnish; and we claim these several improvements substantially as herein set forth and specified.

And, secondly, we claim the manufacture of the peculiar solutions of pyroxylene herein described, and the making of the said pyroxylene, in the manufacture of which we can utilize the waste acids, and re-

employ them with great economy, as also herein more fully set forth and specified.

In witness whereof, we, the said Stephen Barnwell and Alexander Rollason, have hereunto set our hands and seals this thirteenth day *day* of March, in the year of our Lord one thousand eight hundred and sixty-one.

STEPHEN BARNWELL. [L. S.]
ALEXANDER ROLLASON. [L. S.]

290 (Counsel for defendant objects as before.)

Counsel for complainants now give notice that on the hearing of this cause they will refer the court to the Supreme Court record in the case of the Goodyear Dental Vulcanite Co. v. Benoni E. Gardner, for the purpose of showing that there is no material fact proved in this case which was not proved in that case; and also for the purpose of showing that in that case there are many facts proved adverse to *to* the complainants which are not proved in this case; and they also give notice that on the hearing of this cause they will refer the court to the record of the case in the U. S. circuit court for the southern district of N. Y., against Adolph P. Preterre, for the purpose of showing that there is no material fact favorable to the defence proved in this case which is not proved in that case. And, for the like purpose, they will refer to the records of the several cases referred to in the bill in which the testimony in said Preterre case was used.

Counsel for defendants submits to the court that the above notice is entirely irregular; and will ask the court to relieve them from the effect of such blind notice and of such irregular practice.

Thereupon the complainants close.

291 UNITED STATES OF AMERICA,
Massachusetts District, ss:

I, John G. Stetson, clerk of the circuit court of the United States for the first circuit and district of Massachusetts, certify that the foregoing is a true copy of the pleadings and evidence for the complainants in the cause in equity entitled The Goodyear Dental Vulcanite Company, complainants, v. Charles G. Davis, defendant, in said circuit court determined.

And I further certify that this volume, entitled Vol. I, Pleadings and Evidence for complainants, and an accompanying volume, entitled
292 Vol. II, Evidence for defendant and opinion of the circuit court, having my certificate of even date herewith annexed thereto, contain a true copy of the record and of all proceedings (including the opinion of this court) in said cause.

In testimony whereof I hereunto subscribe my name and affix the seal of said circuit court, at Boston, in said district, this thirteenth day of October, in the year of our Lord one thousand eight hundred and seventy-seven, and of the Independence of the United States the one hundred and second.

[SEAL.] JOHN G. STETSON, *Clerk.*

292a TRANSCRIPT OF RECORD.

VOL. II.

Evidence for defendant and opinion of the circuit court.

Circuit court of the United States, district of Massachusetts. In equity.

THE GOODYEAR DENTAL VULCANITE COMPANY, complainants,
v.
CHARLES G. DAVIS, DEFENDANT.

293 The following is a copy of the printed copy of proofs filed in the clerk's office by the defendant, pursuant to the stipulation filed September 14th, 1876, and is the evidence for defendant used at the hearing of said cause before this circuit court, namely:

294 United States circuit court, district of Maine. In equity.

GOODYEAR DENTAL VULCANITE COMPANY
vs.
DAVID B. STROUT.

SAME
vs.
JEREMIAH MASON.

SAME
vs.
CHARLES F. WARD.

SAME
vs.
GEORGE F. TOWLE.

SAME
vs.
N. & L. P. WOODBURY.

295 SAME
vs.
CHARLES E. HUSSEY.

Testimony taken on behalf of defendants for a final hearing, under and in pursuance of rule sixty-seven of the Supreme Court, in equity, as amended, before John A. Shields, esq., special examiner.

NEW YORK, *August* 15, 1876—11 a. m.

Present, Henry Baldwin, jr., and E. Luther Hamilton, esqs., of counsel for defendants; and Edward N. Dickerson and Benjamin F. Lee, esqs., of counsel for complainants.

To save time and expense, it is agreed that either party may offer and put in evidence printed copies of any depositions or documentary exhibits from the records of the case of the Goodyear Dental Vulcanite Company and Josiah Bacon against Daniel H. Smith, in the United

States circuit court for the district of Massachusetts, without further proof; and such copies shall be taken and used as parts of the record in this case, the same as if regularly taken and proved herein.

Counsel for defendants thereupon offers and puts in evidence four hundred and thirty-three printed pages of testimony and exhibits in the said Smith case, which is hereto annexed and marked Defendant's Exhibit No. 2, J. A. S., ex'r.

(For offer of Defendant's Exhibit No. 1, see compl't's proofs, p. 46.)

Defendant's counsel further offers and puts in evidence
296 certified copy of reissued letters patent No. 5928 to the Celluloid Manufacturing Company, assignees of John W. Hyatt, jr., and I. S. Hyatt, and the same is marked Defendant's Exhibit No. 3, J. A. S., ex'r.

Also certified copy of letters patent No. 85927, dated January, 1869, to John B. Newbrough, assignee of Robert Haering, and the same is marked Defendant's Exhibit No. 4, J. A. S., ex'r.

Also certified copy of U. S. letters patent to Charles Goodyear, dated June 15, 1844, and the same is marked Defendant's Exhibit No. 5, J. A. S., ex'r.

Also certified copies of reissued letters patent No. 156 and No. 157, being reissues of said Exhibit No. 5, and the same are marked Defendant's Exhibits Nos. 6 and 7, J. A. S., ex'r.

Also certified copies from the U. S. Patent Office of the following English letters patent, to wit:

No. 11135, dated March 18, 1846, to Thomas Hancock, which is marked Defendant's Exhibit No. 8, J. A. S., ex'r.

No. 11208, dated May 15, 1846, to Charles Hancock, which is marked Defendant's Exhibit No. 9, J. A. S., ex'r.

No. 11209, dated May 15, 1846, to H. V. Bartlett, which is marked Defendant's Exhibit No. 10, J. A. S., ex'r.

No. 24, dated October 1, 1852, to Moses Poole, which is marked Defendant's Exhibit No. 11, J. A. S., ex'r.

No. 43, dated October 1, 1852, to Moses Poole, which is marked Defendant's Exhibit No. 12, J. A. S., ex'r.

Also certified copy from the Patent Office of the file and contents in the matter of the application of John A. Cummings, for letters
297 patent No. 43609, granted to him under date of June 7, 1864, and the same is marked Defendant's Exhibit No. 13, J. A. S., ex'r.

Adjourned to August 16, 1876, at 11 o'clock a. m.

NEW YORK, *August* 16, 1876—11 a. m.

Present, counsel as before.

Adjourned to August 17, 1876, at 11 a. m.

NEW YORK, *August* 17, 1876—11 a. m.

Present, counsel as before.

Deposition of I. Smith Hyatt.

I. SMITH HYATT, a witness called on behalf of defendants, being duly sworn, testifies as follows:

Q. 1. What is your name, age, residence and occupation?

A. My name is I. Smith Hyatt; age, 47 years; residence, Newark, N. J.; and occupation, manufacturer of celluloid and articles from celluloid.

Q. 2. Are you the same I. Smith Hyatt who was examined in these cases on the part of the complainant?

A. I am.

Q. 3. What is celluloid?

A. It is a compound of vegetable fibre and gum camphor, with the coloring matter in some cases.

Q. 4. Please produce samples of the materials of which celluloid is made, in the condition in which they are prepared and mixed.

298 A. I produce a piece of paper made from linen stock (which is marked Defendant's Exhibit No. 14, J. A. S., ex'r); also a sample of the same kind of paper after it has been treated with acids and ground into a pulp; the sample is dry (marked Defendant's Exhibit No. 15, J. A. S., ex'r); also a sample of comminuted gum camphor, such as is used in the manufacture of celluloid (marked Defendant's Exhibit No. 16, J. A. S., ex'r); also a bottle containing a mixture of soluble paper pulp, comminuted camphor, with a small proportion of oxide of zinc and of vermillion as coloring matter (marked Defendant's Exhibit No. 17, J. A. S., ex'r).

Q. 5. How is the celluloid dental plate blank formed or shaped?

A. By being moulded in heated dies.

Q. 6. In what shape is it when put into the heated die?

A. In the shape of this piece which I now produce.

(The piece produced is put in evidence and marked Defendant's Exhibit No. 18, J. A. S., Ex'r.)

Q. 7. Please produce samples of the forms in which the celluloid dental plate blanks are made and sold.

A. Here is a sample of a number 4½ upper set of a celluloid dental plate blank (which is marked Defendant's Exhibit No. 19, J. A. S., Ex'r); this is a sample of a No. 3½ lower set celluloid dental plate blank (marked Defendant's Exhibit No. 20, J. A. S., Ex'r); this is a sample of a No. 6 partial set celluloid dental plate blank (marked Defendant's Exhibit No. 21, J. A. S., Ex'r).

Q. 8. Does celluloid contain any rubber, caoutchouc, gutta-percha, or other allied gum?

A. It does not.

Q. 9. Does it contain any sulphur?

A. It does not.

Q. 10. What effect has heat upon celluloid in the form of these Exhibits 18, 19, 20, and 21?

299 A. A suitable degree of heat softens it.

Q. 11. After it has been softened by heat, what is its condition or character when again allowed to cool?

A. Precisely the same as before being softened by heat.

Q. 12. Do you know what are designated as vulcanizable compounds?

A. A mixture of caoutchouc and sulphur is a vulcanizable compound.

Q. 13. Do you know the effect of vulcanization upon a vulcanizable compound?

A. It changes the soft mixture to a hard substance.

Q. 14. How is this hard substance designated?

A. It is designated as hard rubber or vulcanite.

Q. 15. What are the characteristics of hard rubber or vulcanite; and in what do the characteristics of celluloid resemble or differ from those of hard rubber or vulcanite?

A. Hard rubber is, in brief, a hard, brittle material, which may be softened a little by heat, but not sufficiently to allow it to be moulded

into the form of a set of artificial teeth. Celluloid is a hard and tough material, which may readily be softened by heat and moulded into the form of a set of artificial teeth, or in any other desired form. In general, hard rubber cannot be remoulded for the purposes of dentistry, while celluloid can.

Q. 16. Are you familiar with the process of making a set of teeth on a base of hard rubber or vulcanite, and with the process of making a set of teeth on a base of celluloid?

A. I am.

Q. 17. In what respect do said processes differ from one another, if at all?

A. In both cases a plaster mould is made, modeled to the required shape to fit the mouth, with the teeth arranged in the moulds in proper position; in the case of rubber the flask containing the mould and
300 teeth is heated; soft or mixed rubber taken, also heated to make it soft, and a suitable amount pressed into the mould with the fingers; after a sufficient amount has so been pressed into the mould to fill the space between the two halves of the flask, the other half of the flask is pressed and clamped together with its counterpart, so that the soft rubber completely fills the space in the mould; in the case of celluloid a celluloid blank similar to Exhibit 19, 20, or 21 is placed into the part of the flask containing the teeth, and the other part of the flask placed upon it; the two parts of the flask are held apart by the celluloid dental plate blank at this stage; now the flask and contents are placed into a heating and pressing apparatus, and heat applied sufficient to soften the celluloid blank; pressure is then applied by means of a screw and the two parts of the flask gradually forced together, moulding the celluloid blank into the exact shape of the mould, filling it in all parts; as soon as the flask is together it is cooled off, the moulded plate removed from the flask and finished; in the case of the rubber, after the flask has been brought together containing the mixed unvulcanized rubber, it is put into a vessel containing water, closed tight, and heated up to about 320 degrees, and kept at that degree of heat for from an hour and a quarter or thereabout and upwards. After it has been subjected to this 320 degrees of heat for about an hour and a quarter it is cooled off, taken out of the flask, and the mixed rubber that was, is found to be transformed by the action of heat into hard rubber or vulcanite, properly shaped for a set of artificial teeth. It is then finished.

Q. 18. How long does it require to complete the celluloid plate from the time it is put into the heating and pressing apparatus?

A. Generally about twenty-five minutes is required from the commencement to the completion of the moulding.

Q. 19. Can celluloid be packed into the mould a little at the time and moulded into the dental plate? If not, why not?

301 A. It can't be sufficiently softened under a heat that would allow it to be handled, it requiring a very heavy degree of pressure under a higher degree of heat. If pieces were put in they would not unite or weld together to form a homogenous mass.

Cross-examined by Mr. DICKERSON:

X Q. 20. Are you not pecuniarily interested in the Celluloid Manufacturing Company as a stockholder or otherwise?

A. I am a stockholder in that company.

X Q. 21. Does not the Celluloid Manufacturing Company pay the expenses of defending these suits?

A. We pay the expenses of defending dentists who are prosecuted for using celluloid.

X Q. 22. Were you not examined as a witness for the defendant in the case of the Goodyear Dental Vulcanite Co. and Josiah Bacon against Adolph P. Preterre in the circuit court of the United States for the southern district of New York?

A. I was.

X Q. 23. Was not Mr. Henry Baldwin, who appeared as of counsel in that case for the defendant, employed by the Celluloid Manufacturing Company to perform that service?

A. He was employed by the Celluloid Manufacturing Company to defend Dr. Preterre in the use of celluloid and in nothing else.

X Q. 24. Have you ever had any practical experience as a manufacturer of vulcanized rubber; if so, where and when?

A. I never manufactured any vulcanized rubber.

X Q. 25. Have you any knowledge of the properties and qualities of vulcanite or hard rubber in the process of its manufacture, except what some one has told you? If so, where and when did you acquire that knowledge?

302 A. The only knowledge I have as to the manufacture of hard rubber is what I have acquired from reading, conversing with others, seeing dentists make vulcanite sets of teeth, and having been, on two or three occasions, for very short times, in three rubber factories; one a factory at Newark for making overshoes, another a factory at Newark for making rubber coated harness trimmings, and another a factory at New Brunswick for making buttons and other articles.

X Q. 26. In the course of your reading where did you find it written or printed that "hard rubber is a hard brittle material"?

A. I don't remember to have ever read that description of it—don't remember whether I have or not.

X Q. 27. Who told you then that "hard rubber is a hard brittle material"?

A. I have frequently heard dentists call it brittle.

X Q. 28. Who was the dentist that told you that "hard rubber is a hard brittle material," and when did he tell you that, and who was present when he communicated that information?

A. I don't remember any particular dentist. I know however that with those dentists with whom I have had conversations on the subject of rubber, they generally call it brittle or liable to be easily broken; and I know it better by my own experience in hard rubber by breaking it in my hands; from dropping hard rubber combs to the floor and their breaking, and from hearing dentists say that if a set of hard rubber teeth were allowed to fall on the floor there would be danger of its breaking.

X Q. 29. Did those dentists that gave you that information inform you that they were under injunction restraining them from the use of that brittle material?

A. I don't think that more than one in a hundred of the dentists with whom I have conversed about rubber told me that they were under injunction.

X Q. 30. Haven't the dentists informed your company that if they were required to pay for a license under the Cummings patent, they would use rubber and not use celluloid?

303 A. I don't know of any case of the kind, but I do know that many dentists have told me that they would use celluloid in preference to rubber, license or no license.

X Q. 31. Didn't the Celluloid Manufacturing Company file an affidavit sworn to by M. Clifford Lefferts in the case of the Celluloid Manufactur-

ing Company against the Goodyear Dental Vulcanite Company, alleging that if the dentists were required to pay a license fee under the Cummings patent, that would break up the business of the Celluloid Manufacturing Company, so far as the manufacture of dental blanks was concerned?

(Objected to as incompetent, and not the proper way to prove the act inquired about.)

A. I have no clear recollection of the contents of Mr. Lefferts' affidavit, and couldn't with any certainty give the contents without having the affidavit before me.

X Q. 32. I now show you the affidavit of M. Clifford Lefferts, sworn on the 24th day of February, 1876, in the case of the Celluloid Manufacturing Company against the Goodyear Dental Vulcanite Company, in U. S. circuit court for the southern district of New York, annexed to a notice of E. Luther Hamilton, solicitor for complainant, that the same will be read upon the motion for the preliminary injunction in that cause, in which the following statement is made: "The agents of our co. also inform us, and I believe such information to be true, that unless the threats of prosecution by the Goodyear Dental Vulcanite co. of the customers of our co. are stopped, the dentists will cease entirely to use celluloid, and that branch of our business be wholly destroyed." Was that a true statement when it was sworn to?

(Objected to as irrelevant and incompetent, the witness not having sworn to the statement, and Mr. Lefferts not being a witness in these cases.)

304 A. That's not my opinion exactly, because some dentists have told me that they would use celluloid under any circumstances, if they had to pay the license or not; but it would seriously interfere with our business, because I have heard dentists say that if they were enjoined from using celluloid they would neither use rubber or celluloid, and of course that would interfere with our business.

X Q. 33. I did not ask you for your opinion, I asked whether M. Clifford Lefferts' affidavit was true, that "the agents of our co. also inform us that unless the threats of prosecution by the Goodyear Dental Vulcanite Co. of the customers of our co. are stopped, the dentists will cease entirely to use celluloid"?

(Objection repeated.)

A. I do not know whether that is true or not.

X Q. 34. What officer of the Celluloid Manufacturing Company, when he made that affidavit, was M. Clifford Lefferts?

A. He was treasurer of the company.

X Q. 35. Was it his business "to read and answer letters ad'ressed to the said company relating to its business"?

A. It was not exclusively his business.

X Q. 36. Among other letters annexed to the affidavit of M. Clifford Lefferts, is one purporting to be signed by C. E. Bartlett, who says: "I write this in behalf of a large number of dentists who are awaiting an answer from you," and who makes the following statement, "If we are obliged to pay a license to Bacon, of course we shall use rubber and the sale of celluloid plates will be small;" was such a letter received by the Celluloid Company and annexed to that affidavit, as Mr. Lefferts swears it was?

(Objected to as incompetent and irrelevant.)

305 A. I don't know personally, I never saw the letter that I know of.

X Q. 37. Did you never hear of that statement or of similar ones, made by dentists to your company until to-day?

A. I don't remember of any statements by dentists precisely like that; but I do remember that letters have frequently come from dentists urging us to defend their use of celluloid, and that our business as well as theirs would be seriously damaged if the Goodyear Dental Vulcanite Company succeeded in their suits.

X Q. 38. How did you suppose your business would be injured in consequence of the dentists paying for a license, under the Cummings patent, if your material is any better than rubber for the purpose of dental plates?

A. I don't remember of having made such supposition.

X Q. 39. Had you no reason for the opinion which you have expressed in this examination, that your business would be affected by the success of the Goodyear Dental Vulcanite Company's case? And if you had, please explain it to the court.

(Objected to because the witness has not expressed the opinion attributed to him in the question.)

A. Please refer me to that opinion which you say I have expressed.

X Q. 40. I refer you to the answer to cross-question 37.

A. I said in that answer that I remembered dentists having expressed an opinion that their and our business would be seriously damaged if the Goodyear Dental Vulcanite Company succeeded in their suits.

X Q. 41. Do you mean by this last answer to intimate that, in your opinion, the business of the Celluloid Manufacturing Com-
306 pany, so far as dental blanks are concerned, would not be injured by the success of the Goodyear Dental Vulcanite Company's case?

A. I didn't mean to make any intimation on the subject.

X Q. 42. Is it your opinion that the business of the Celluloid Manufacturing Company would be injured by the success of the complainants in this suit?

A. That is my opinion.

X Q. 43. If it is true, as you allege in letters patent No. 113055, March 28, 1871, that a dental plate or base for artificial teeth, manufactured in the manner therein described, is superior to one made of vulcanite, how could it injure your manufacture and business, that the dentists were required to pay for a license, whether they used celluloid or rubber, under the Cummings patent?

A. So far as dentists who pay for a license under the Cummings patent come to learn and appreciate the truth of that statement, our business would not be interfered with.

(Counsel for complainant, before putting any other questions to the witness, requests counsel for defendant to add to the stipulation already made in these causes, and dated June 27, 1876, a more particular designation of the causes referred to in the first paragraph of said stipulation, and spoken of as those which are defended by Henry Baldwin, jr., esq., as of counsel, in order to make such designation of cases clearly extend, as it was intended to extend, to all cases defended by the Celluloid Manufacturing Company, or its counsel.

Mr. Baldwin submits that this request is out of place, and out of time, and unprofessional, as an interjection in the cross-examination of this witness, and declines to make any designation of the causes referred to in the stipulation, which certainly speaks for itself, and has so far nothing to do with the cross-examination of this witness in these causes, to which the stipulation specifically applies.)

307 X Q. 44. State, if you please, under what employment Henry

Baldwin, jr., esq., is acting in these cases, and state whether or not he is employed by the Celluloid Manufacturing Company under a general employment for the purpose of defending dentists using celluloid in various parts of the United States, who have been sued by the Goodyear Dental Vulcanite Company upon the Cummings patent.

A. He is employed by the Celluloid Manufacturing Company in these cases; but I do not understand that he is employed to defend any suits except such suits as we may designate to him.

X Q. 45. Have you not employed him to defend all the suits, as counsel, in which answers have been filed, and in which appearances have been entered by counsel employed by your company?

A. I do not understand that we have employed him except in suits where answers have been filed by him, or under his direction.

X Q. 46. Have not all the answers filed by counsel employed by your company since the 27th day of June, 1876, in defense of dentists sued for using celluloid upon the Cummings patent, been filed under his direction?

(Objected to, as it does not appear that the witness knows whether any answers have been filed by counsel employed by the company since the 27th day of June, 1876, or whether any such answers have been filed under Mr. Baldwin's direction; and further objected to as of wide departure from any possible line of cross examination, seeming to tend to some personal attack upon Mr. Baldwin, which can have nothing to do with the examination in chief of this witness; and Mr. Baldwin requests the examiner to note that while the examination of this witness up to the answer to cross-question No. 43 was conducted by Mr. Dickerson, from that point on it is taken in charge by Mr. B. F. Lee, and he objects to this as irregular.)

308 A. I do not know.

X Q. 47. State all the counsel and solicitors, giving their names and residences, who are employed by your company and associated with Mr. Baldwin in the defence of dentists sued for using celluloid by these complainants.

A. I cannot, for I do not know.

I. SMITH HYATT.

Subscribed and sworn to before me, this 17th day of August, 1876.

Deposition of William H. H. Colburn.

WILLIAM H. H. COLBURN, a witness called on behalf of defendants, being duly sworn, testifies as follows:

Q. 1. What is your name, age, residence, and occupation?

A. My name is William H. H. Colburn; age, 36 years; residence, Newark, N. J.; and occupation, dentist.

Q. 2. How long have you been familiar with practical operations in dentistry; and what experience have you had in the manufacture of sets of artificial teeth; and of what material have you made such sets?

A. I have been familiar with practical operations in dentistry for 14 years; I have been familiar during the whole of this time with the manufacture of artificial teeth; I have made sets of continuous gum, gold, silver, rubber, Weston's metal, celluloid, pure tin; I have made others of other materials, but they were experimental.

Q. 3. How long did you work on rubber?

A. I worked on rubber until November, 1874.

Q. 4. How long have you worked on celluloid?

A. From November, 1874, to the present time.

309 Q. 5. Please produce a rubber set of teeth and state if you made it and how it is made?

A. I have none here of my own manufacture, but here is a set.

(The set is marked defendant's Exhibit No. 22, J. A. S., ex'r.)

Q. 6. Are you in business for yourself?

A. I am not.

Q. 7. For whom do you work?

A. Dr. Worthington Pinney, of Newark, N. J.

Q. 8. State how a set of hard rubber or vulcanite teeth like Exhibit No. 22 is made, according to your practice in that material?

A. I can explain it all the way through from the beginning; the teeth are ground to a gutta-percha plate; they are then imbedded in wax, or "waxed up," as we call it; they are then imbedded in an iron flask in plaster; the rubber is then put in in a plastic state and the flask is then immersed in boiling water in order to bring the flask together and get the perfect shape of the plate; it is then put in a vulcanizer and subjected to 320 degrees of heat for one hour; it is then cooled off and then finished; sometimes it requires an hour and ten minutes, sometimes longer.

Q. 9. How do you get the gutta-percha plate to which the teeth are ground?

A. It comes in sheets prepared for that purpose.

Q. 10. How do you form the gutta-percha plate on which the teeth are waxed up?

A. By either immersing it in boiling water or by dry heat.

Q. 11. How do you get the shape of the intended rubber plate?

A. That is got by imbedding the gutta-percha plate in the flask first, then separating the flask after the plaster has hardened, then removing the gutta percha and wax, washing the two parts of the flask with boiling water to remove the wax from the teeth in the cast,

310 then packing the rubber by the aid of boiling water, when it is put into the vulcanizer and hardened.

Q. 12. What is this gutta-percha plate called?

A. It is called trial plate.

Q. 13. What does that signify in your practice, that term "trial plate"?

A. It is the plate we get the articulation with.

Q. 14. How do you get that articulation with the trial plate?

A. By placing a sufficient quantity of wax on the ridge of the plate, to enable the patient to make a suitable impression with the under or upper teeth.

Q. 15. How is this impression obtained from the patient?

A. By biting into the wax while soft.

Q. 16. Can you produce a set of teeth that you have mounted on celluloid?

A. I can, and now produce it; I made this set myself.

(Marked defendant's Exhibit No. 23, J. A. S., exr.)

Q. 17. State how you make a celluloid set like Exhibit No. 23?

A. I first mount my teeth on a gutta-percha plate, after which I trim it as I want the plate to be; it is then imbedded in a flask until the plaster has hardened, after which it is separated, the trial plate and wax being removed; it is then cleansed with boiling water (the two parts of the flask); I then put in a celluloid blank, and submit it to 290 degrees of heat in the glycerine apparatus, at which heat it will pack; when the flask is thoroughly together it is taken out and immersed in cold water until thoroughly cool, after which it is finished.

Q. 18. How long does it take to make a set on celluloid, as you have described?

A. From twenty minutes to forty, to pack it, after the case is ready.

Q. 19. By the term to pack it, what do you mean?

A. To bring the blank down, so as to produce the plate for the mouth.

311 Q. 20. How long, lest I should misunderstand you, is the celluloid blank in the flask subjected to heat, in the glycerine apparatus?

A. From twenty to forty minutes; that is all the time that I generally require.

Q. 21. What would be the condition of the rubber plate, at the end of twenty minutes, after it was put in the heat you have mentioned, if then taken out and cooled?

A. I could not say, as I never tried it in glycerine.

Q. 22. Have you made a vulcanite blank, similar to the celluloid blank? and if yea, please produce the same and state how you made it.

A. I have, and produce the same: I made it by imbedding a No. 6½ celluloid blank in a flask prepared for rubber work in the same manner that I would imbed a set of teeth, packing and vulcanizing it the same, after removing the celluloid blank.

(Marked Defendant's Exhibit No. 24, J. A. S., exr.)

Q. 23. Have you endeavored to make a set of teeth on a vulcanite blank, and if yea, state how you succeeded, and produce the result of the experiment?

A. I did try to make a case with a rubber blank, but it amounted to nothing; it was a failure; I produce the flask and the plate.

(Marked Defendants' Exhibit No. 25, J. A. S., exr.)

Q. 24. State how you did this?

A. I first vulcanized a blank, and endeavored to pack it to a set of teeth the same as I would a celluloid blank, in preparing a case of celluloid.

Q. 25. To what heat, and in what, and how long did you subject it in your endeavors?

A. I meant to say that I subjected it to 212 degrees of heat in boiling water in a glycerine apparatus; I subjected it to the heat of the boiling water for fifty-eight minutes.

312 Q. 26. Did you try it again with another vulcanized blank?

A. I did.

Q. 27. Can you produce the result of that experiment?

A. I can, and now produce it.

(Marked Defendants' Exhibit No. 26, J. A. S., exr.)

Q. 28. Is this exhibit in the condition in which it came from the mould or flask, that is, with only two teeth adhering to the teeth, and in other respects?

A. Yes, sir; it is.

Q. 29. Is Exhibit No. 24 in the condition in which it came from the flask, or what has been done to it since it has been vulcanized?

A. It is the same with the exception of cutting the surplus off that ran over the flask, and brushing the plaster off with a brush.

Q. 30. How were the letters and figures on the vulcanite blank, Exhibit No. 24, produced thereon?

A. By the impression in the plaster of the celluloid blank.

Q. 31. For how many years prior to November, 1874, did you work in rubber?

A. I had worked in rubber twelve years and eight months.

Q. 32. Please say how long you subjected the vulcanite blank, Exhibit No. 26, to heat, and to what degree of heat, and in what apparatus?

A. I subjected it to heat an hour and ten minutes at 312 degrees of heat in the steam tight apparatus made for packing celluloid.

Q. 33. Can you state from your knowledge whether the hard rubber or vulcanite in a set of teeth like Exhibit No. 22 formed a perfect joint between the teeth and the plate, and if not, how you know it does not?

A. My experience has been that it does not, it does not hug the teeth so closely as other materials that I have worked in for artificial work; my experience has been that there is a certain shrinkage after vulcanization.

313 Q. 34. Have you ever found anything behind the teeth or between them and the plate in vulcanite work that showed the joint or hug not to be perfectly tight, and if yea, what was it?

A. I have found in taking teeth off of new or old plates either some of the polishings back of the teeth on the new plates or food and polishings back of teeth on old plates.

Q. 35. What is the polishings you refer to?

A. The material that smooths or glosses the plate; pummice stone powdered is used first to give it a surface, which is then glossed by whiting.

Q. 36. Have you ever removed teeth from new or old celluloid plates, and if yea, have you found polishings or food and polishings back of the teeth in such sets?

A. I have found no cases in my experience with celluloid.

Q. 37. In vulcanite work where gum teeth were used, have you found anything, if yea, what, behind the teeth showing that the vulcanite did not hug teeth so as to make a tight joint?

A. I have found polishings and food behind them.

Q. 38. Did you ever find anything else behind the teeth in vulcanite work where gum teeth were used?

A. I have been able by squeezing the plate back of the teeth with my thumb pretty hardly to cause moisture to come from between the plate and the teeth.

Q. 39. Have you ever found a rubber plate to be still in the soft condition and not vulcanized after it had been in the vulcanizer, at a vulcanizing temperature for some time, and if yea, how long a time had it been?

A. I have had a number of cases, after being in the vulcanizer for one hour and ten minutes at 320 degrees heat, where it came out soft.

Q. 40. How did you treat those cases upon ascertaining that they were soft, to harden them?

A. By immediately closing the flasks returning them to the vulcanizer, and subjecting them to another heat of from thirty minutes to one hour and ten minutes.

314 Q. 41. Was the rubber compound different, as far as you know, in these cases from that ordinarily used by you in your dental vulcanite work?

A. Not as I know of. The fault may have been with the rubber, although rubber out of the same box would vulcanize at an hour ten.

Q. 42. Can you produce a vulcanite blank, made as you have described Exhibit 24 to have been made, but which has been polished up?

A. I can show one not quite so large *so* Exhibit No. 24. It was made from an impression of a No. 4 celluloid blank.

(Marked Defendant's Exhibit No. 27.—J. A. S., Exr.)

Q. 43. Compare Exhibit No. 24—a vulcanite blank—with Exhibit No.

19—a celluloid blank—and state wherein their characteristics or properties resemble or differ from each other.

A. The only way I can explain that is that one is celluloid and one is rubber; that one will flow under a certain degree of heat—290 degrees, the celluloid blank—and the other would not flow at 312 and 212, the two heats I subjected it to.

Q. 44. Are they both equally hard?

A. The rubber is harder than the celluloid when vulcanized.

Q. 45. Are they both equally strong?

A. My experience is that the celluloid is the strongest.

Q. 46. Are they both equally tough?

A. My experience is that the celluloid is the toughest of the two—that it will cut with more ease than the vulcanized rubber.

Q. 47. Can celluloid be packed in moulds, as rubber is packed; and if not, why not?

A. It can be packed. I can't answer that question, because I never tried it.

315 Q. 48. How long have you been practically familiar with continuous gum work?

A. A little over 14 years.

Q. 49. During what portion of this period have sets of teeth of that kind been worn by persons for whom you have made artificial teeth?

A. Some have been wearing them *them* for ten, twelve, and fourteen years.

Q. 50. To what extent has there been a demand for continuous gum work in your experience during the last 14 years?

A. I have made quite a good many sets, but, owing to its high price, there has been more of a demand for cheaper work.

Cross-examined by Mr. DICKERSON:

X Q. 51. Isn't your employer at present sued by the Goodyear Dental Vulcanite Company, for infringing the Cummings patent?

A. I cannot honestly say whether he is. My impression is that he is.

X Q. 52. How long have you been in his employment?

A. It will be two years the 8th of next month.

X Q. 53. What wages do you receive?

A. Eighteen dollars a week.

X Q. 54. How long have you been receiving that pay?

A. Since I have been with Dr. Pinney.

X Q. 55. Isn't it a very serious objection to a set of teeth that the teeth are not in contact with the base, and that the food can find its way into the joints and behind the teeth?

A. It is.

X Q. 56. Do you think that a set of teeth in that condition is fit to be worn?

A. I do not.

X Q. 57. Didn't you mean by your answers to the direct questions to have the court believe that that was the usual condition of sets of teeth on a vulcanite base?

316 A. I did.

X Q. 58. Then, in your opinion, vulcanite sets of teeth are not fit to be worn; is that not so?

A. That is my opinion, sir.

X Q. 59. Don't you think, upon the whole, that metallic bases are very preferable to vulcanite?

A. Only two metals—continuous gum and Weston's metal.

X Q. 60. Don't you think that a gold plate is very superior to vulcanite, where the joints are all open for food and where they must become very foul? If not, where is the superiority of vulcanite over gold?

A. I consider the vulcanite the best of the two, as there is less chance for food to get back of the teeth than in gold work.

X Q. 61. Tell the court how you found out that celluloid was stronger than vulcanite. Explain the experiments by which you made that discovery.

A. By making a practical case for a patient who had broken up two rubber sets and one continuous gum set, who has been wearing the celluloid set since a year ago last May, without their being impaired.

X Q. 62. Wouldn't you infer that celluloid was stronger than platinum from the fact that the man broke up the platinum set and has not yet broken the celluloid one?

A. I should.

X Q. 63. Explain to the court the experiment by which you discovered that vulcanite was harder than celluloid.

A. By taking one piece each of celluloid and vulcanite, the same thickness, and finding that the vulcanite would break under a less strain than the celluloid.

X Q. 64. Don't you think that a piece of pine wood would break under a less strain than celluloid?

A. It might and it might not. I never tried the experiment.

317 X Q. 65. If a piece of pine wood of the same shape as one of these celluloid blanks would break easier than the blanks, would you infer that the pine wood was harder than the celluloid?

A. I should.

X Q. 66. When did you discover that vulcanite would shrink?

A. By making a vulcanite and a celluloid plate on similar models, and then, after finishing, filling them with plaster and taking a mold from them, and then allowing them to stand for about five days, when I noticed that, while the vulcanite plate had changed from the cast at the end of two days, the celluloid plate fitted the cast perfectly.

X Q. 67. Doesn't plaster shrink in drying?

A. It does shrink some.

X Q. 68. Which was it—the plaster or the vulcanite, that shrunk when you tried that interesting experiment?

A. I think both of them did.

X Q. 69. Don't you think that the plaster shrunk in the celluloid plate also?

A. If it did I did not notice it particularly.

X Q. 70. Where were you employed before you went to Dr. Pinney's, and how long?

A. I was with Dr. Charles S. Stockton, at Newark, for eighteen months.

X Q. 71. What wages did you get there?

A. Twenty dollars a week.

X Q. 72. Why did you leave that employment and take less wages?

A. I did not leave it to take less wages.

X Q. 73. Why did you leave it?

A. Because Dr. Stockton wished an assistant to operate at the chair as well as in the laboratory.

X Q. 74. Do you call yourself a dentist?

A. I am a mechanical dentist.

X Q. 75. Are dentist and a mechanical dentist the same or different?

318 A. There are two kinds of dentists—operative and mechanical.

X Q. 76. Have you had any education as a dentist?

A. Only such as I have received by constant work in the business—practical work.

X Q. 77. Isn't your business to make sets of artificial teeth in the workshop?

A. Not altogether.

X Q. 78. Do you operate on natural teeth?

A. There are certain operations that I do perform on natural teeth.

X Q. 79. What kind of operations do you perform?

A. I fill and extract teeth and treat diseased teeth.

X Q. 80. Is not that what surgeon dentists do?

A. There are more difficult operations that surgeon dentists perform, some of them.

WM. H. H. COLBURN.

Subscribed and sworn to before me this 17th day of August, 1876.

Adjourned to August 18, 1876, at 11 o'clock a. m.

NEW YORK, *August* 18, 1876—11 a. m.

Present, counsel as before.

Deposition of John Allen.

JOHN ALLEN, a witness called on behalf of defendants, being duly sworn, testifies as follows:

319 Q. 1. What is your name, age, residence, and occupation?

A. My name is John Allen; age, 66 years; residence, No. 7 West 33rd street, New York City; and occupation that of a dentist.

Q. 2. How long have you been practicing as a dentist?

A. Some forty-five or forty-six years.

Q. 3. Were you at one time at Cincinnati, Ohio?

A. Yes, sir; I formerly resided there.

Q. 4. While residing there, did you procure letters patent of the United States for a mode of setting mineral teeth?

(The examination of this witness is objected to, so far as it may tend to show prior knowledge of the invention covered by the complainant's patent, because he is not properly named in the answer.)

A. Yes, sir.

Q. 5. Look at the copy of letters patent No. 8621, dated December 3, 1851, on pages 197, 198, and 199 of Defendant's Exhibit No. 2, with the plate opposite page 197, and state if that is the patent referred to.

A. Yes, sir; that is the patent.

Q. 6. How long have you practiced your profession in the city of New York?

A. I think about twenty-three years.

Q. 7. Since the date of this patent of yours, or before that, have you made for your patients sets of teeth in the mode described in the patent; and if yea, are they still in use and in demand, and to what extent?

A. Well, I have made them as described in the patent, and some of them are still in use, although I cannot tell to what extent.

Q. 8. Have you made sets of teeth on metallic plate according to the mode described in this patent; and if yea, can you produce a case of such teeth?

A. Yes, sir, I have, and I produce a case of such teeth.

320 (Set of teeth produced put in evidence, and marked Defendant's Exhibit No. 28, J. A. S., Ex'r.)

Q. 9. How is this work designated?

A. It is called continuous gum work, without seam or crevice.

Q. 10. How long has this work been designated and known as continuous gum work?

A. Over twenty years.

Q. 11. Is there still any demand for these continuous gum teeth?

A. Yes, sir; the demand is increasing constantly; it has maintained its integrity beyond all question.

Q. 12. To what extent have you supplied sets of continuous gum work to your patients?

A. I don't know as I can answer exactly, but it would number many thousands of sets—several thousand at least.

Q. 13. Will you produce a set of continuous gum work in an unfinished stage of its manufacture, and state what that stage is?

A. I produce the set, with what we call the first coat of body on it; the teeth are arranged upon the plate, and then the first coat of body is applied, after the teeth being soldered to the plate.

Q. 14. Please describe how the coat of body is applied in this continuous gum work, and in what condition it is when first applied, and how it is brought to the condition shown in the exhibit which is now offered in evidence, and marked Defendant's Exhibit No. 29, J. A. S., Ex'r?

A. The compound when it is applied to the plate and teeth is in a soft plastic state; it is applied with a little instrument called a spatula, and then carved as it becomes a little dryer, which is in a few minutes; then hardened in a furnace by heat.

Q. 15. Are the cracks which I observe in this Exhibit No. 29

321 produced in the process of bringing the case to the stage shown in this exhibit; and if so, what produce them?

A. The process of baking by the contraction of the material.

Q. 16. Are those cracks closed in the further process of making the set?

A. Yes, sir; entirely so.

Q. 17. How?

A. By the process of baking or enameling when the enamel is applied.

Q. 18. In this continuous gum work, is the joint between the teeth and the vitrified material continuous, or is it limited to the edges of the compound?

A. It is solid all the way through—no difference between the edges and the other parts; you can't get one of those teeth out without breaking it.

Q. 19. In your practice with continuous gum work, have you generally used teeth having pins?

A. As a general thing we do, although they could be worked without.

Q. 20. Is there any, and, if yea, what, objection to continuous gum work by those who use sets of teeth thereupon?

A. I know of no objection, as a general rule, by those who wear them, if they are properly adapted to the mouth.

Q. 21. Have you yourself worn a set of continuous gum work?

A. I have for at least twenty years.

Q. 22. What do you find as to the weight of such sets?

A. I find the weight no objection whatever; it is not perceptible in the mouth if well adapted.

Q. 23. What do you find as to the action of foods or fluids taken into the mouth, or the juices of the mouth, upon the continuous gum?

A. It is entirely incorrodable in the mouth.

322 Q. 24. What do you find as to the purity and cleanliness of the continuous gum work?

A. It is perfectly pure, sweet, and cleanly; there is nothing impure about it; by many years of wear in the mouth there is no appreciable change.

Q. 25. Are there any crevices intervening between the plate, the gums, and the teeth, in this continuous gum work?

A. No, sir; when it is made as it should be—packed in closely and carefully.

Q. 26. Have you furnished patients with sets of continuous gum work in place of vulcanite or hard rubber sets which they had been wearing?

A. I have, many of them.

Q. 27. Have you observed the condition of such vulcanite sets after use?

A. Yes, sir; I find them to have changed their color more or less in all cases, according to the length of time they have been worn.

Q. 28. How did you find them compare with continuous gum work, as to the perfection of the joints, or fit of the hardened compound around the teeth?

A. The fit with the continuous gum is more perfect than with the hard rubber or vulcanite, because it forms part and parcel of the same, and cannot be separated; in baking, the teeth soften a little and unite with the gum, which with the vulcanite they do not.

Q. 29. From your knowledge and experience in dentistry, what do you say as to the yielding of the dental plate to the motions of the mouth in mastication?

A. I think there is no special advantage of any yielding; there may be; the yielding that takes place in the mouth in mastication is in the natural gum; whether in the vulcanite or continuous gum, there is no perceptible yielding beyond that.

Q. 30. In artificial dentures, is not weight essential in some; and if yea, in what, cases?

323 A. In full lower sets weight is an advantage; if very light, they are more apt to float about in the mouth.

Cross-examined by Mr. DICKERSON:

X Q. 31. About how much would you charge a patient for a set like Exhibit No. 28?

A. $125 for an upper set; $250 for a full set.

X Q. 32. About how much is the raw material of that set worth?

A. It is about like asking what the canvass is worth under a $10,000 picture.

X Q. 33. You mean by that illustration that the value of the material is a very insignificant part, do you not?

A. Yes, sir; it is the skill and the result that stamps the value.

X Q. 34. Does it require much skill in the dentist to make a good set of continuous gum teeth?

A. Yes, sir; more than in making any other style of work.

X Q. 35. In which of the results is the skill most illustrated?

A. In the preparation of the material, thorough knowledge of the laws of heat, and the practical use of the furnace; and knowledge as to

the degree of heat, and the purity of the fire when the work is introduced; the gas must all have escaped; the operator must know when the fire is in proper condition to put the work in.

X Q. 36. Where can one learn this various knowledge, so that he could produce a piece of work like Exhibit No. 28?

A. He could learn it in my laboratory, or in the laboratory of others who do the work; aside from theory, practical observation would be necessary.

X Q. 37. Does it require long experience and practice to produce a perfectly fitting and perfectly tight set of teeth, such as Exhibit No. 28 is supposed to be?

324 A. If the learner were to commence at the beginning, of making the material and then applying it, I think six months would be as short a time as would be required, and then he must be a good dentist too; I mean by that that he should be considered an expert, able to do good work, and perfectly at home in all the manipulations; I mean, to produce as good work as Exhibit No. 28; but as it is usually done, we furnish the material, and the manipulation in doing the work when the material is found and ready prepared, the manipulation could be acquired in much less time.

X Q. 38. Is not the metallic base struck up in dies, the same as gold plates?

A. Yes, sir.

X Q. 39. Is not such a set as No. 28 at least twice as heavy as a rubber set for the same mouth would be?

A. I think very likely.

X Q. 40. Do you think that no disadvantage?

A. No, sir, not a particle; the difference is not perceptible to the patient.

X Q. 41. In Mr. Hyatt's patent, No. 113,055, he makes this statement in respect to the celluloid base: "First, it is lighter, and at the same time stronger than dental vulcanite or hard rubber;" assuming it to be true that it is lighter than hard rubber, would you think that an advantage?

A. I should not think there was any practical difference; I never made either rubber or celluloid, and therefore have no experience; my practice is confined exclusively to this continuous gum work. Theoretically, our patients would think the lighter the better; it sounds beautifully in the ear.

Redirect by Mr. HENRY BALDWIN, Jr.:

R. D. Q. 42. Do you know what are the proportions of the constituents in dental rubber prepared to be made into vulcanite dental plates?

325 A. According to the analysis of Prof. Barker, the composition is 36 parts mercury, 24 parts sulphur, 40 parts rubber. I never analyzed it myself.

R. D. Q. 43. Is this analysis of Prof. Barker published and accepted as authority?

A. It has been quoted as authority in large assemblages, and not contradicted.

Re-cross by Mr. E. N. DICKERSON:

R. X Q. 44. Who is the largest manufacturer and furnisher of dental supplies in this country?

A. Samuel S. White, of Philadelphia.

R. X Q. 45. Do you consider him a good authority on the subject of dental supplies?

A. Tolerably so; I should think as good as any we have.

R. X Q. 46. Look at the paper now shown you, purporting to be signed by Samuel S. White, under the title "Bow Spring Rubber," do you recognize that as Samuel S. White's publication?

(Objected to as incompetent.)

A. I should take it for granted that that is about so, as Mr. White says; I can't see anything to contradict that; I have no doubt of it; the proportions of the constituents, I presume, have been varied from time to time.

Complainant's counsel offers in evidence the paper publication referred to by the witness, (the same being an advertisement printed on the outside cover of the Dental Cosmos for July, 1876,) and the same is marked Complainant's Exhibit Dental Cosmos, J. A. S., ex'r.

Complainant's Exhibit Dental Cosmos.—J. A. S., Ex'r.

BOW SPRING RUBBER.

The strongest, most elastic, and most easily packed.

(Vignette.)

Trade-mark, No. 1847. Registered June 23d, 1874.

326 This rubber is made of the best Para gum, carefully selected, is thoroughly freed from foreign substances, and is manufactured by improved processes. It contains more gum to the pound than ordinary rubbers—having less specific gravity—and is cheaper to the user, first, because it takes more sheets to make a pound; and second, because, being much stronger, it can be made into thinner plates. It will, by reason of its fine texture, receive and retain a high polish.

We believe it to be the best gum in the market.

CAUTION.—The purity of the bow spring rubber requires it to be more carefully vulcanized than any other. Ordinary rubbers contain much more foreign substances, clays, or coloring matters, which separate the particles of gum and allow the sulphureted hydrogen gas to escape, thus effecting a more speedy vulcanization. The bow spring rubber, however, should not be packed like these with dry heat; that is, the flask containing the rubber should never be exposed in an open fire, as is often done with other rubbers. Our experiments with the bow spring indicate that the best results are attained by allowing the heat 15 minutes to reach 260°, then raising it gradually to 320°, and keeping it at that point for 50 minutes. Other experiments in England, with a vulcanizer of different construction from those used in America, give 300° at 45 minutes. If the plate is unusually thick, a longer time at a lower heat is to be preferred.

The point to be borne in mind is, that the heat should be allowed to penetrate the whole plate and effect a personal vulcanization from within outwards, instead of the imperfect results of the contrary way; and by exercising the care here suggested the bow spring rubber will produce the strongest and most elastic rubber denture known.

327 42 WESTBOURNE GROVE, BAYSWATER,
London, England.

Dr. SAMUEL S. WHITE:

DEAR SIR: I think you would like to know how your "Bow Spring Rubber" is liked over here. Allow me to say that since I have once tried it I have used no other, and I think dentists are (or ought to be) greatly indebted to you for bringing such an article before them. I have a piece in my surgery now, about three inches long, that none of my patients can break. I have recommended it to several dentists.

Yours, very truly,

EDWARD BARKER.

Price per pound $3 50

SAMUEL S. WHITE.

Philadelphia, New York, Boston, Chicago.

Witness says: Practically, I have no knowledge; I speak from the confidence I have in Samuel S. White, who is the publisher of the Dental Cosmos.

JOHN ALLEN.

Subscribed and sworn to before me this 18th day of August, 1876.

328 IRA STARR, a witness called on behalf of defendant, being duly sworn, testifies as follows:

Q. 1. What is your name, age, residence, and occupation?

A. My name is Ira Starr; age, 56 years; residence, 455 Grand street, New York City; and occupation, dentist.

Q. 2. What experience have you had in the manufacture of vulcanite dental plates, or sets of artificial teeth on vulcanite plates?

A. Fifteen years.

Q. 3. Have you made a case of soft rubber in the condition it is when the flask is closed, and before it is subjected to the vulcanizing heat? and, if yea, please produce such case.

A. I produce such case; it got torn in its present shape by adhering to the plaster mould.

(Case offered in evidence and marked Defendant's Exhibit No. 30, J. A. S., ex'r.)

Q. 4. Can you produce a set of rubber teeth which has been subjected to the vulcanizing heat for twenty-five minutes and then removed from the flask?

A. I produce a set which has been subjected to the vulcanizing heat for twenty-five minutes.

(The same is offered in evidence and marked Defendant's Exhibit No. 31, J. A. S., ex'r.)

Q. 5. Can you produce a set showing the condition of the vulcanizable rubber after it has been subjected to the heat of the vulcanizer for forty minutes?

A. I produce a set which has been subjected to 110 pounds steam gauge, which is 310 degrees Fahrenheit, for forty minutes.

329 (The same is offered in evidence and marked Defendant's Exhibit No. 32, J. A. S., ex'r.)

Q. 6. To what temperature was Exhibit No. 31 subjected during the twenty-five minutes?

A. One hundred and ten pounds steam gauge, or 310 degrees Fahrenheit.

Q. 7. At what temperature, and for how long time have you been in the habit of vulcanizing dental plates in your practice?

A. One hour shortest, and one hour and ten minutes as a general rule, at one hundred and ten steam gauge, or 310 degrees Fahrenheit.

Q. 8. Of what kind of rubber, or what preparation are these three exhibits made?

A. Dougherty's rubber, No. 2.

Q. 9. Is that a good vulcanizable compound?

A. That I consider the best; I always use it when I work it.

Cross-examination waived.

IRA STARR.

Subscribed and sworn to before me this 18th day of August, 1876.

Adjourned to August 19, 1876, at 10 o'clock a. m.

NEW YORK, *August* 19, 1876, 11 a. m.

Present, counsel as before.

Deposition of Alfred Starr.

ALFRED STARR, a witness called on behalf of defendants, being duly sworn, testifies as follows:

330 Q. 1. What is your name, age, residence, and occupation?

A. My name is Alfred Starr; age, 53 years; residence Mount Vernon, N. Y., and occupation dentist.

Q. 2. How long have you been in practise and where?

A. Thirty-two, four or five years, principally in this city.

Q. 3. In the course of your practice, have you made any and what use of gutta-percha?

(The examination of this witness is objected to so far as it tends to show prior use or knowledge of the patentee's invention, because he is not named in the answer.)

A. I have made use of it principally for temporary work.

Q. 4. Please explain what you mean by temporary work?

A. The phrase is used when the work is required to be used but a short time.

Q. 5. What kind of work is meant by this?

A. I mean gutta-percha formed into dental plates.

Q. 6. Did those plates have teeth in them?

A. They did.

Q. 7. Please describe your manner of making a set of teeth on a gutta-percha plate and of securing the teeth to the plate.

A. In the first place I get the impression of the mouth; then from that I get a plaster mould; cover that plaster mould with tin foil, then warm the gutta-percha to make it plastic; while in the plastic state I shape it in the mould, then warm the teeth, place them in position on the gutta-percha and finish up with a spatula. Another mode I sometimes use in making a female mould and a counter die and warm the gutta-percha to a plastic state, and the impression of those two together form the plate for the teeth. I should have said, that to prevent it ad-

hering to the plaster, I give it a coating of para'fine. And again I have used it in metal dies in the same form.

331 Q. 8. In your gutta-percha dental plates, what attachment did you have between the teeth and the plate?

A. When I first used it I had to form a plate of silver, riveted on to the back of the teeth, making the silver plate long enough so that I could punch it full of holes for the gutta-percha to pass through; after rubber teeth came in use I didn't require that.

Q. 9. Did you make any gutta-percha plates without silver plates at the back of the teeth; and, if yea, how were the teeth and plates connected in those cases?

A. By the pins being made longer and bent in the proper shape, or headed like a pin head, which would retain it.

Q. 10. When did you first use this mode of connecting the teeth with the gutta-percha plate by pins, without the back plate?

A. I could hardly say; but I should judge about twenty years.

Q. 11. Have you made more than one such temporary plate for patients of pure gutta-percha, with only the pins, during the last twenty years?

A. I have.

Q. 12. How many such gutta-percha sets have you made for your patients during such time?

A. I might have made a hundred or two hundred; I cannot tell.

Q. 13. How long have you known one of these temporary plates to be worn by a patient?

A. About a year.

Q. 14. What is their general time of use?

A. They generally last from six to eight months.

Q. 15. Have you made at my request, and, if yea, please produce a case of teeth on a base of pure gutta-percha?

A. I have, and produce a set.

(Plate put in evidence and marked Complainants' Exhibit No. 33, J. A. S., Exr.)

332 Q. 16. Please produce a piece of the gutta-percha from which you made this plate, Exhibit No. 33, state where you got it and what you did with it, by way of preparing it to make a plate.

A. I produce a piece of the gutta-percha; I got it at Smythe & Earle's in this city; I think the number is 69 William street; I put it into hot water until it is melted or becomes softened; I then rub it to get out all the foreign substances and dirt that I can, and continue that process until it is nearly clean or quite; then it is ready for use.

(Piece of gutta-percha put in evidence and marked Defendants' Exhibit No. 34, J. A. S., Exr.)

Q. 17. Did you put anything whatever with it after you had cleansed it as you have described?

A. I did not.

Q. 18. Please describe how you made this plate Exhibit No. 33.

A. I in the first place took the plaster model and got a counter model from it in plaster by pressure; I warmed the gutta-percha and made it plastic and pressed it in the moulds.

Q. 19. How did you attach the teeth to the plate in making this Exhibit No. 33?

A. I got a model of wax, the same as this plate is; the case is then put into these dies; the wax is removed; the gutta-percha being then in its plastic state takes the place of the wax and forms around the teeth, the same as the wax did.

Q. 20. What is there in this Exhibit No. 33 to secure and hold the teeth and plate together besides the gutta-percha?

A. There is a groove around what we term the neck of the tooth, and pins being bent in the proper form, the gutta-percha retain' the teeth.

333 Q. 21. Look at the row of teeth now shown you and say how far they are the same as the teeth in Exhibit No. 33?

A. They are the same form.

(Teeth put in evidence and marked Defendants' Exhibit No. 35, J. A. S., Exr.)

Q. 22. How long have you known such teeth as these to be made with the groove and long pins?

A. I couldn't tell exactly; fifteen or sixteen years since the continuous gum work commenced; I would state that the groove at that time was a little different; it ran down slimmer, and there were several grooves instead of one; the roots ran down to a point.

Q. 23. These particular teeth in Exhibit No. 33 I gave you, did I not, for the purpose of making a gutta-percha plate with?

A. Yes, sir.

Q. 24. Does this plate, Exhibit No. 33, possess sufficient strength for use in the mouth?

A. It does for a while.

Q. 25. Are you familiar with the composition of dental rubber prepared for making dental vulcanite plates?

A. I have made it.

Q. 26. What are its componets and the proportions of them?

A. It is sulphur, vermillion and rubber; I used to use four to six ounces of sulphur, seven ounces of vermillion, and a pound of rubber.

Q. 27. How long have you known of the use of the compound called "Hill's Stopping" for dental purposes?

A. I couldn't say how many years; I should think it must be nearly sixteen to eighteen years; I couldn't tell certain.

Cross-examined by Mr. DICKERSON:

X Q. 28. Are you practising dentistry at present?

A. Very little.

X Q. 29. What are you engaged in?

334 A. Experimenting most of the time in different things.

X Q. 30. Explain the different things, and where you carry on your experiments?

A. In Mount Vernon; part of the time at 169 Mercer street; experiments in one thing is binding for hats, garments, or anything where binding is required to be put upon the hats or garments without sewing; another thing is an imitation of leather, an artificial leather; another thing is an invention flocking hats, making them look like wool or silk; another thing is a filling for teeth called Hill's Improved Stopping.

X Q. 31. Were you acquainted with Asa Hill in his lifetime?

A. I was.

X Q. 32. Are you acquainted with Samuel S. White?

A. I have seen him, but am not acquainted with him.

X Q. 33. Did you have anything to do with Asa Hill in 1873?

A. In don't know whether it was in 1873 or what year it was; it was a year or two before he died; I can't tell in what year it was.

X Q. 34. Did you assist him at that time in making up a set of gutta-percha teeth?

A. I never did; Asa Hill was at my son's office at that time; I don't know what they were doing.

X Q. 35. Was your son a dentist?

A. He was.

X Q. 36. When you used gutta-percha for temporary sets, did you not use the prepared gutta-percha sold to dentists for dental uses?

A. Not unless it was to vulcanize.

X Q. 37. What kind of gutta-percha did you use for those temporary suits?

A. I used gutta-percha; there is only one kind that I know of; I used gutta-percha supplied by the manufacturers.

335 X Q. 38. Don't you know that there is a difference in the gutta-percha supplied by manufacturers, such as Bishop & Company, and crude gutta-percha?

A. The difference is what we term "washed clean," while the crude is not.

X Q. 39. Don't you know that Bishop & Co. furnish gutta-percha for dental purposes?

A. I do not.

X Q. 40. Didn't you know in years past that Bishop & Co., or some other manufacturers, furnished gutta-percha for dental purposes?

A. I did; not Bishop & Co.

X Q. 41. Was not that the kind of gutta-percha you bought for dental purposes?

A. Not for temporary sets, unless it was to be vulcanized.

X Q. 42. Did you buy the crude gutta-percha for temporary sets?

A. I bought the washed gutta-percha—pure gutta-percha was what I called for.

X Q. 43. What kind of teeth did you use on these temporary sets?

A. I have used what they call the plain plate-teeth, and what we term the rubber-teeth, and what we term the continuous-gum teeth.

X Q. 44. These are all such as are ordinarily used in making a vulcanite set, are they not?

A. No.

X Q. 45. Were they such as you bought in the dental depots where they were kept in the stock for sale?

A. They were.

X Q. 46. Now, suppse they were continuous-gum teeth; explain how they were fixed to the gutta-percha base?

A. The same as I did the others; I have explained that already.

336 X Q. 47. With that sort of teeth the base of gutta-percha is inside of the teeth entirely, is it not, leaving the teeth plastered up against the outside of the gutta-percha gum?

A. No, sir; it is not.

X Q. 48. Are not the continuous-gum teeth, as ordinarily made, pointed at their roots; and having a couple of metallic pins projecting inward, at right angles to the length of the tooth?

A. I have seen them made with what is termed a loop; sometimes they have a head in the form of a head of a pin. They are pointed at their roots; some are and some are not; they are made different ways.

X Q. 49. How were those made which you used twenty years ago, for temporary sets on a gutta-percha base; and who made them, and where did you get them?

A. I used plain teeth, what they call plate teeth, short pins; by facing it with a piece of silver riveted on the teeth—sometimes soldered; leaving the silver backing long enough so I could perforate it with holes.

X Q. 50. Was more than one tooth riveted to the same silver backing?

A. No, sir.

X Q. 51. How long was the silver backing to each tooth?

A. It might have been a quarter to half an inch long.

X Q. 52. Was not that silver piece bent inwardly to conform to the curve of the alveolar ridge?

A. It was.

X Q. 53. What was the object of perforating that silver backing with holes?

A. So that it might retain its hold on the gutta-percha.

X Q. 54. Who was the inventor of that mode of making temporary sets with gutta-percha, so far as you know?

A. I don't know who the inventor was.

X Q. 55. Where did you learn how to do it?

A. Well, I suppose I got hold of it by hearing others talk about it; I can't tell now.

337 X Q. 56. Read the translation from the "Comptes Rendus," of a communication by Delabarre, which is pages 399 and 400 of Defendants' Exhibit No. 2 in this case, and say whether the mode described therein is the same as that which you practiced for setting the teeth in the gutta-percha base?

A. No, I should judge not.

X Q. 57. Did you ever make any permanent set of teeth, in the way you have described, of gutta-percha?

A. Not what we call permanent teeth.

X Q. 58. When you made Exhibit No. 33, why didn't you use the same kind of teeth and the same mode of fastening that you say you used to do for temporary sets of teeth?

A. I prefer this kind of teeth to the others, since they were manufactured.

X Q. 59. Did Mr. Baldwin inform you who was the inventor of this kind of teeth, and when that invention was made, and for what purpose; that is, teeth such as Exhibit No. 35, with flat bottoms, and buttons on their lower ends?

A. I don't think he did; I don't remember.

X Q. 60. When did you first see them?

A. I couldn't tell you; I have seen so many different shapes it is impossible for me to tell.

X Q. 61. Were you not informed by Mr. Baldwin, or some other person, that those teeth were invented and manufactured in 1873, for the purpose of being used in a so called gutta percha plate that was manufactured by Asa Hill and exhibited in the case of the Goodyear Dental Vulcanite Company against Daniel H. Smith?

A. No, sir; I don't remember being told so by any one.

X Q. 62. When Mr. Baldwin brought you those button teeth, was there no explanation of any kind given for their shape?

A. Not for their shape, no.

X Q. 63. Was nothing said to you by any one in regard to those teeth, or the object for which they had been made?

338 A. Not for the object for which they had been made, that I remember.

X Q. 64. Was nothing said about the effect that was expected from those buttons?

A. Not that I remember.

X Q. 65. State what was said, as near as you can recollect, about those teeth.

A. He wished me to take them and insert them in a gutta-percha case (that was about all that was said), and bring them to him.

X Q. 66. Who was present when this occurred, and where was the interview?

A. Mr. Hamilton was present; it was at the Fifth-Avenue Hotel.

X Q. 67. Did you happen to be at the Fifth-Avenue Hotel, or did you come there by design? Explain all the circumstances that brought you to that interview when you received these button teeth.

A. I received a notice from Mr. Baldwin, that he would like to see me at the Fifth Avenue Hotel; he stated no reasons; I went there and saw him.

X Q. 68. Had you no former interview with any person in respect to your being employed to put these button-teeth into a gutta-percha base?

A. No, sir.

X Q. 69. Where did you receive this message, and in what form was it?

A. A telegraphic message to me at Mount Vernon.

X Q. 70. Did your son never speak to you on the subject before you got this telegram?

A. He did not.

X Q. 71. Did no other persons ever speak to you on the subject before you received the telegram?

A. No one.

X Q. 72. Did you tell Mr. Baldwin that permanent sets of teeth had been made by you, or to your knowledge, with a pure gutta-percha base?

A. No, sir.

339 X Q. 73. Was that subject never spoken of between you?

A. He might have asked me if they would answer for a permanent set.

X Q. 74. And what did you tell him?

A. I never used them for permanent sets.

X Q. 75. When he asked your opinion, didn't you give him one?

A. I told him I didn't think they could be used for permanent sets.

X Q. 76. Were you not a witness in the case of the Goodyear Dental Vulcanite Company et al. against Adolphe P. Preterre, in the United States circuit court for the southern district of New York?

A. I think I was.

X Q. 77. Were you not asked, and did you not answer the following questions and answers in that case; namely, 4 to 7, both inclusive, cross-question 55 to redirect question 61, both inclusive, as follows:

"Q. 4. How long have you been engaged in making plates to hold artificial teeth?

"A. I commenced about thirty-two years ago; I commenced it when I first went into the business, but not for myself.

"Q. 5. During all that time, have you kept yourself informed of the various improvements and changes that have been made in the art?

"A. I have endeavored to do so to the best of my ability.

"Q. 6. Are you familiar with the use of hard rubber or vulcanite, as a base for artificial teeth?

"A. Yes, sir.

"Q. 7. How long have you been so?

"A. Since between the years 1855 and 1856, to the best of my recollection.

"Cross-Q. 55. Have you ever tried to vulcanize rubber without closing it in a mould?

"A. I have.

340 "Cross-Q. 56. What was the result?

"A. The rubber expands and becomes porous like a sponge.

"Cross-Q. 57. Then it is impossible is it not to vulcanize rubber so as to make hard rubber or vulcanite without confining it in a mould during the process of vulcanization?

"A. I should consider it impossible, without being confined in a mould, or its equivalent.

"Cross-Q. 58. Prior to your use of rubber, what kind of plates did you make for permanent use and for mastication?

"A. Gold and silver, and platinum to some extent; and they were sometimes carved out of bone.

"Cross Q. 59. Nothing else was used by the profession, at that time, was there?

"A. Not to my knowledge.

"Cross-Q. 60. Please describe how these metal plates were fitted to the mouth.

"A. I first took an impression of the patient's mouth in wax; I then ran plaster on the wax, and got a plaster model of the mouth; this plaster model was immersed in melted lead and held there until the lead cooled and hardened; then the plaster was knocked out of the lead, and then the lead was smoked, and then hard metal, zinc, or type metal—zinc was nearly always used—was cast against the lead, thus forming the male die, the lead being the female die; then we knocked them apart, and placed a sheet of the metal, cut out of suitable shape, between the dies, and swedged the plate between them; we then tried it in the mouth to see if it fitted, and then the teeth were ground to fit in the proper places, and then encased in sand and plaster around the outer face of the teeth, or convex side of the set of teeth, the teeth having been previously arranged upon the metal plate in the position required, by means of wax placed around the inner or concave side of the set of teeth; when the sand and plaster become hard enough to hold the

341 teeth in position, we removed all the wax, and then lined or backed the teeth by riveting gold upon the teeth; each tooth for metal work is provided with two pins; the gold is held by those pins by being riveted; each tooth or block of teeth had its own piece of gold; the whole is then gently heated to a red heat, and the backings are soldered to the plate, thus attaching the teeth to the plate; in making what are known as continuous gum sets of teeth, the plates being made of platinum, we dispensed with the backing and soldered the pins to the plate

"Redirect Q. 61. How early did you make metal sets in this manner?

"A. Thirty-three and thirty-four years ago."

A. I find on reference to the record that I so testified.

Redirect examination by Mr. BALDWIN:

R. D. Q. 78. Was your son ever, and if yea, when, in practice or employed in the city of Philadelphia?

A. He never was.

R. D. Q. 79. State, if you know, what the gutta percha sold for dental purposes, or as now called, dental gutta percha contains.

A. There is two kinds; one a very soft substance used for getting out models of plates, making trial plates; the other is for vulcanizing; I do not know what they contain.

ALFRED STARR.

X Q. 65. State what was said, as near as you can recollect, about those teeth.

A. He wished me to take them and insert them in a gutta-percha case (that was about all that was said), and bring them to him.

X Q. 66. Who was present when this occurred, and where was the interview?

A. Mr. Hamilton was present; it was at the Fifth-Avenue Hotel.

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"Q. 5. During all that time, have you kept yourself informed of the various improvements and changes that have been made in the art?

"A. I have endeavored to do so to the best of my ability.

"Q. 6. Are you familiar with the use of hard rubber or vulcanite, as a base for artificial teeth?

"A. Yes, sir.

"Q. 7. How long have you been so?

"A. Since between the years 1855 and 1856, to the best of my recollection.

"Cross-Q. 55. Have you ever tried to vulcanize rubber without closing it in a mould?

"A. I have.

340 "Cross-Q. 56. What was the result?

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"Cross-Q. 58. Prior to your use of rubber, what kind of plates did you make for permanent use and for mastication?

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"Cross Q. 59. Nothing else was used by the profession, at that time, was there?

"A. Not to my knowledge.

"Cross-Q. 60. Please describe how these metal plates were fitted to the mouth.

"A. I first took an impression of the patient's mouth in wax; I then ran plaster on the wax, and got a plaster model of the mouth; this plaster model was immersed in melted lead and held there until the lead cooled and hardened; then the plaster was knocked out of the lead, and then the lead was smoked, and then hard metal, zinc, or type metal—zinc was nearly always used—was cast against the lead, thus forming the male die, the lead being the female die; then we knocked them apart, and placed a sheet of the metal, cut out of suitable shape, between the dies, and swedged the plate between them; we then tried it in the mouth to see if it fitted, and then the teeth were ground to fit in the proper places, and then encased in sand and plaster around the outer face of the teeth, or convex side of the set of teeth, the teeth having been previously arranged upon the metal plate in the position required, by means of wax placed around the inner or concave side of the set of teeth; when the sand and plaster become hard enough to hold the

341 teeth in position, we removed all the wax, and then lined or backed the teeth by riveting gold upon the teeth; each tooth for metal work is provided with two pins; the gold is held by those pins by being riveted; each tooth or block of teeth had its own piece of gold; the whole is then gently heated to a red heat, and the backings are soldered to the plate, thus attaching the teeth to the plate; in making what are known as continuous gum sets of teeth, the plates being made of platinum, we dispensed with the backing and soldered the pins to the plate

"Redirect Q. 61. How early did you make metal sets in this manner?

"A. Thirty-three and thirty-four years ago."

A. I find on reference to the record that I so testified.

Redirect examination by Mr. BALDWIN:

R. D. Q. 78. Was your son ever, and if yea, when, in practice or employed in the city of Philadelphia?

A. He never was.

R. D. Q. 79. State, if you know, what the gutta percha sold for dental purposes, or as now called, dental gutta percha contains.

A. There is two kinds; one a very soft substance used for getting out models of plates, making trial plates; the other is for vulcanizing; I do not know what they contain.

ALFRED STARR.

Subscribed and sworn to before me this 19th day of August, 1876.

Testimony for defendants closed.

342 *Defendants' Exhibit No. 1.—J. A. S., Ex'r.*

(65.)

DEPARTMENT OF THE INTERIOR.

(Vignette.)

U. S. PATENT OFFICE.

To all persons to whom these presents shall come, greeting:

This is to certify, that the annexed is a true copy from the records of this office, of the letters patent granted Albany Dental Plate Company, dated March 28th, 1871, No. 113055, for improvements in dental plates from pyroxyline.

In testimony whereof I, R. H. Duell, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed, this sixteenth day of August, in the year of our Lord one thousand eight hundred and seventy-six, and of the Independence of the United States the one hundred and first.

[SEAL PATENT OFFICE, UNITED STATES OF AMERICA.]

R. H. DUELL,
Commissioner.

No. 113055.

THE UNITED STATES OF AMERICA.

(Vignette.)

To all to whom these letters patent shall come:

Whereas, Isaiah S. Hyatt, John W. Hyatt, jr., and Jesse A. Perkins, of Albany, New York, have alleged that they have invented a new and useful improvement in dental plates from pyroxyline (they having
343 assigned their right, title, and interest in said improvement to Albany Dental Plate Company, of same place); and have made oath that they are citizens of the United States, that they verily believe they are the original and first inventors or discoverers of the said improvement and that the same hath not, to their knowledge and belief, been previously known or used; have paid into the Treasury of the United States, the sum of thirty-five dollars, and presented a petition to the Commissioner of Patents praying that a patent may be issued therefor.

These are, therefore, to grant to the said Albany Dental Plate Company, its successors, executors, administrators, or assigns, for the term of seventeen years, from the twenty-eighth day of March, one thousand eight hundred and seventy-one, the full and exclusive right and liberty of making, using, and vending to others to be used, the said improvement, a description whereof is given in the annexed schedule, and made a part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent Office to be hereunto affixed.

Given under my hand, at the city of Washington, this twenty-eighth day of March, in the year of our Lord one thousand eight hundred and seventy-one, and of the Independence of the United States of America the ninety fifth.

[L. S.]

W. T. OTTO,
Acting Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.

M. D. LEGGETT,
Commissioner of Patents.

344 UNITED STATES PATENT OFFICE.

Isaiah S. Hyatt, John W. Hyatt, jr., and Jesse A. Perkins, of Albany, N. Y., assignors to Albany Dental Plate Company, of same place. Improvement in dental plates from pyroxyline.

Specification forming part of letters patent No. 113055, dated March 28, 1871.

To all whom it may concern:

Be it known that we, Isaiah Smith Hyatt, John Wesley Hyatt, jr., and Jesse A. Perkins, of the city and county of Albany and State of New York, have invented a new manufacture of dental plates, of which the following is a specification:

In the manufacture of dental plates or bases for artificial teeth, vulcanite or hard rubber, which has been extensively employed for the purpose, has been found objectionable on account of its dark color, offensive taste and smell at times, liability to break when chilled, and difficulty of repairing the plates when broken; the large amount of mercury contained in the coloring material (vermilion) employed, which renders it particularly obnoxious to some persons; the length of time required to manufacture the plates and the qualities which render it unpleasant for dentists to manipulate.

345 To obviate these objections various experiments and attempts have been made to substitute for such plates compounds of pyroxyline or solid collodion, which have hitherto failed to accomplish the desired result or production of a superior article. In these experiments collodion has been employed in a partially-dissolved state, in which it is placed in the casts or molds containing the teeth and subjected to pressure, from which plates thus formed the solvent material gradually evaporates. This evaporization is attended with such an amount of shrinkage as to warp the plates and impair their shape, which in connection with the tedious nature of the process, has prevented the adoption of this and similar methods of using pyroxyline.

An attempt has also been made to avoid this shrinkage of the formed plates by subjecting the collodion in a nearly dried state to pressure in heated molds, and then attaching the teeth thereto by the use of powdered collodion and a solvent. This method has also failed of adoption for the reason, among others, that the drying of the material by which the teeth are soldered in place has a tendency to leave the teeth loose, while the connection is rendered still less secure on account of the more porous nature of this soldering material, which is not subjected to pressure, as is the main body of the plates, the line of juncture also being frequently discernible from a difference in appearance.

Our invention consists of a dental plate or base for artificial teeth, composed of a kind of solid collodion, such as is described in letters patent of the United States granted to I. S. Hyatt and J. W. Hyatt, jr., July 12, 1870, numbered 91341, in which the transformation of the pyroxyline is effected by the use of camphor as a solvent, whereby the thoroughly dried product or collodion is rendered plastic by heat, so as to be readily molded without subsequent shrinkage, as hereafter described, and

346 without the use of fixed oils or fusible non-solvent gums, which

are required to be combined with the material when ether, alcohol, or other ordinary solvents are used, which fixed oils and gums forming a part of the permanent compound, impair its qualities of strength, durability, purity, fineness of texture, &c., so essential in a dental plate.

In the manufacture of collodion for our dental plates, we prefer to use at least fifty parts, by weight, of gum-camphor to onehundred parts of soluble cotton. A greater proportion of camphor may be used, whereby the product is rendered more plastic than when a less quantity is employed. The collodion thus produced is made into plates of suitable thickness, and are preferably formed into shapes approximating those of finished dental plates by pressing in heated molds. The plates thus formed are now thoroughly dried by placing them in a drying room heated to a temperature which should not exceed 180° Fahrenheit, 150° to 180° being the temperature we have found best adapted for expelling the camphor solvent. A temperature much higher than 200° will expand the material and render it porous and brittle.

The pltes when properly dried, although freed from liability of shrinkage, still retain the quality which enables them to become plastic under a proper degree of heat, and readily molded into any desired shape without subsequently shrinking to any injurious extent after being so remolded.

In making a set of teeth of our improved base, the case is prepared and teeth set in plaster by the same process and in the same manner as is done in making a set of hard rubber, except that the trial-plate should be made thinner. Care should be taken to use the best quality of plaster, and to thoroughly dry the casts before proceeding with
347 the final process. Around the outside of the teeth, next to the flask, is cut a channel, connected by short channels or gates with the inside to receive the excess of material. When the flasks are thus prepared, a plate of our base is placed in the lower flask and the upper flask upon it, when the two flasks are put into a screw-clamp ready to be forced together. The flasks and clamp are then set into a small tank of oil (good sweet oil works finely and emits no odor), and a gas-jet or alcohol lamp placed under the oil-tank is lighted, and the oil heated to 300° (never above 310° Fahrenheit), which is determined by a thermometer attached to the vessel. As the oil heats, the plate becomes softened and plastic, when the clamp is gradually screwed down to place, scarcely any force being required until the last, when the proper degree of heat being reached, the flasks are forced firmly and completely together. The clamp and flasks are then lifted out of the oil, and if the flasks are seen to be entirely together on all sides, the work of molding is done. The flasks and contents are then immersed in cold water and thoroughly cooled, when, upon opening the flasks, the case will be seen to be molded in the most perfect manner, the teeth firmly attached, and the shape of the plaster molds perfectly taken to the minutest particular. The case is then freed from plaster with brush and water, and finished and polished as would be done with rubber. Chalk is used as a last finish with cotton wheel and water.

Among the advantages of our new base are the following: First, it is lighter, and at the same time stronger, than dental vulcanite or hard rubber. Second, its color is very near that of the natural gum, and will not change in the mouth. Third, it is entirely free from all unpleasant taste. Fourth, it is not injurious to any mouth even the most sensitive, which is not true of rubber plates, containing a large amount of mercury, and is more pleasant and comfortable to the wearer than plates
348 made of any other known material. Fifth, it can be manufactured

and fitted to the mouth easier, quicker, and more satisfactorily to the operator than can be done with any other known base for artificial teeth, saving time and trouble enough to the operator to pay for the plate, requiring only from one third to one-quarter of the time used in working rubber. Everything is neat, convenient, and clean, and no unpleasant odor fills the room or attaches to the hands of the dentist. Sixth, after being thoroughly dried it is easily rendered plastic by heat, so as to be readily molded, while it is free from all liability of shrinking and consequent warping and derangement of shape after it has been formed into a set of teeth, which is one of its most important advantages.

What we claim as our invention is—

The dental plate or base for artificial teeth hereinbefore described, as a new article of manufacture.

ISAIAH S. HYATT.
JOHN W. HYATT, JR.
JESSE A. PERKINS, M. D. S.

Witnesses:
ALEX. MCROBERTS,
JAY HYATT.

349 *Defendants' Exhibit No. 3.—J. A. S., Ex'r.*

(65.)

DEPARTMENT OF THE INTERIOR.

(Vignette.)

U. S. PATENT OFFICE.

To all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the reissue letters patent granted the Celluloid Manufacturing Company, dated June 23rd, 1874, No. 5928, for imp't in treating and molding pyroxyline.

In testimony whereof I, R. H. Duell, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this sixteenth day of August, in the year of our Lord one thousand eight hundred and seventy six, and of the Independence of the United States the one hundred and first.

{ SEAL PATENT OFFICE, UNITED STATES OF AMERICA. }

R. H. DUELL,
Commissioner.

No. 5928. Reissue.

THE UNITED STATES OF AMERICA.

(Vignette.)

To all to whom these presents shall come:

350 Whereas John W. Hyatt, jr., and Isaiah S. Hyatt, of Newark, New Jersey, assignors by mesne assignments to the Celluloid Manufacturing Company of New York City, have presented to

the Commissioner of Patents a petition praying for the reissue of letters patent for an alleged new and useful improvement in treating and molding pyroxyline (for which letters patent were issued to them dated July 12, 1870, which letters having been surrendered, the same have been canceled, and new letters ordered to issue to said assignee on an amended specification), a description of which invention is contained in the specification, of which a copy is hereunto annexed and made a part hereof, and have complied with the various requirements of law in such cases made and provided; and whereas, upon due examination made, the said claimants are adjudged to be justly entitled to a patent under the law:

Now, therefore, these letters patent are to grant unto the said the Celluloid Manufacturing Company, its successors or assigns, for the term of seventeen years from the twelfth day of July, one thousand eight hundred and seventy, the exclusive right to make, use, and vend the said invention throughout the United States and the Territories thereof.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the city of Washington, this twenty-third day of June, in the year of our Lord one thousand eight hundred and seventy-four, and of the Independence of the United States of America the ninety-eighth.

B. R. COWEN,
Acting Secretary of the Interior.

Countersigned:
[L. S.]

M. D. LEGGETT,
Commissioner of Patents.

351 UNITED STATES PATENT OFFICE.

John W. Hyatt, jr., and Isaiah S. Hyatt, of Newark, New Jersey, assignors by mesne assignment to the Celluloid Manufacturing Company of New York City. Improvement in treating and molding pyroxyline.

Specification forming part of letters patent No. 105338, dated July 12, 1870, reissue No. 5928, dated June 23, 1874. Application filed May 26, 1874.

To all whom it may concern:

Be it known that we, John W. Hyatt, jr., and Isaiah Smith Hyatt, late of Albany, New York, but now residing at Newark, in the county of Essex, and State of New Jersey, have jointly invented certain new and useful improvements in processes of converting pyroxyline and making solid collodion, of which invention the following is a specification:

Pyroxyline is one of the well understood forms of nitro-cellulose; that is to say, it is cellulose which has been subjected to the action of sulphuric and nitric acids, and thereby rendered susceptible of transformation into collodion by the action of solvents. Now, it is the object of our invention to effect this transformation without the use and waste of expensive solutions or solvents, as heretofore, and with the smallest practicable proportion of the converting agent compatible with a rapid process and a homogeneous product, the collodion resulting from our improved converting treatment of the pyroxyline being solidified, and in this form available as a substitute for horn, ivory, bone, &c., while at the same time it is capable of being rendered

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plastic by heat, of being, while in a plastic state, molded into any desired form or shape, and, after being thus molded, of resuming its hardness and retaining its shape.

Our invention is based upon our discovery, made in the course of our experiments towards the attainment of this object, of the fact that gum-camphor in a powdered or finely-comminuted state remains, under ordinary temperatures, inert when mechanically mixed with pyroxyline, of which, in solution or in a liquid state, it is, under ordinary temperatures, an active solvent; and of the further fact that when such a mixture is subjected to heat above the ordinary temperatures the camphor becomes an active converting agent, and transforms the pyroxyline into collodion as effectively as had been done with solutions. And these discoveries enable us to substitute a mechanical mixture for the solutions heretofore employed to keep the converting power latent, or hold it in abeyance until its action can be developed under the best conditions and with the best effect, instead of having to contend with the difficulties incident to the premature and partial action of solutions immediately upon coming in contact with the pyroxyline, and, while ultimately utilizing all the converting power of the camphor, to avoid the expense and loss of solvents such as ether and alcohol, which were driven off or volatilized in the process of transformation. Other latent converting agents may be used in a similar way to effect a similar result.

Our invention accordingly consists in preparing pyroxyline and a latent converting agent for being mechanically mixed, and mixing them in such manner that the converting agent remains inert until the compound is subjected to a treatment that develops its converting
353 power, and also in subjecting a compound of pyroxyline and a latent converting agent to a treatment which will develop the power of the converting agent, thereby transforming the pyroxyline into solidified collodion without the intervention of solutions or volatile solvents.

In the practice of our invention, we prepare pyroxyline by grinding it in water to a fine pulp in a machine such as is used in grinding paper-pulp. We strain off the water as far as practicable, and then subject this pulp to powerful pressure—for example, in a perforated vessel—to further expel the aqueous moisture, and to bring it to a comparatively solid and dry state, yet still retaining sufficient moisture to prevent it from burning in the further stages of the process.

We comminute gum-camphor by grinding it in water, or, preferably, by pounding or rolling it, and thoroughly incorporate, with the pyroxyline-pulp in the condition last above described, this finely-comminuted camphor, in about the proportion of one part, by weight, of camphor to two parts, by weight, of the pyroxyline in the pulp. These proportions may, however, be somewhat varied with good results. The moisture in the pulp serves to counteract any tendency of the camphor to prematurely develop its converting power under any stimulus incident to its being incorporated with the pulp, or to the further stages of the process.

With the camphor we also thoroughly incorporate, with the pulp, any pigments, coloring matter, or other materials that may be adapted to the requirements of the articles into which the product is to be manufactured. The camphor, or camphor and other ingredients, having been thus thoroughly mixed with the pulp, we next subject the mass to a powerful pressure, in order to expel the remaining aqueous moisture,
354 and thereby not only dry the mixture, but force the camphor into more intimate contact with the pyroxyline throughout the mass, so

that every atom of the camphor shall be in condition and place to exert its utmost converting power as developed.

The dried and compressed mass is next placed in a suitable mold or vessel, open at the top, and into this open top is fitted a platen or plunger. The vessel is then placed in a hydraulic or other powerful press, and a heavy pressure, applied to the platen or plunger, is brought to bear upon the mixture, which, while thus under pressure, is heated up by steam or other convenient means to a temperature of from 150° to 300° Fahrenheit, varying according to the quantity of the mixture, and the mixture is kept at this temperature and under this pressure until the converting power of the camphor shall have been exerted upon the pyroxyline throughout the mass, the heat developing the latent converting power of the camphor and the camphor exerting its converting power actively upon every atom of the pyroxyline, with which the pressure maintains it in close contact. The process of transformation is rapidly effected and is completed almost as soon as the mass attains its maximum temperature, the resulting product being a homogeneous product, solidified collodion, or collodion compound, having the qualities or properties hereinbefore specified. This product, as it comes from the press, is of a consistency resembling that of sole leather; but upon exposure to the atmosphere it hardens by reason of a slight evaporation of the camphor.

The ultimate product includes, however, a large proportion of the camphor as a permanent accretion to the mass, which accretion is not only a great gain over the use of ether, alcohol, or other solutions or volatile solvents, which would be entirely expelled or lost, but by its presence gives the solidified collodion or compound the new capability of being again rendered plastic by heat and remolded into any desired form or shape without requiring the use of solutions or volatile solvents, or the addition of fusible gums as heretofore.

355 Having thus described the nature and object of our discovery and invention, what we claim and desire to secure by letters patent is—

1. The combination of pyroxyline with camphor gum, or any equivalent converting agent, in such manner that the transforming action of the converting agent is kept latent, substantially as and for the purposes set forth.

2. The method, substantially as herein described, of developing the latent power of the converting agent by the application of heat to a mixture of pyroxyline and gum camphor or its equivalent, for the purposes set forth.

3. The method, substantially as herein described, of making solid collodion by subjecting a mixture of pyroxyline and a latent solvent to heat and pressure.

4. The method, substantially as herein described, of converting pyroxyline into solid collodion by the use of solid solvents.

5. The new material herein described, consisting of pyroxyline and gum camphor or its equivalent, with or without the addition of other substances to increase its body or change its color, the same being capable of being softened by heat and remolded or formed, as described.

JOHN W. HYATT, JR.
ISAIAH SMITH HYATT.

Witnesses:
CHAS. E. HILL.
RODERICK M. SANGER.

356 *Defendants' Exhibit No. 4.—J. A. S., ex'r.*

(65.)

DEPARTMENT OF THE INTERIOR.

(Vignette.)

U. S. PATENT OFFICE.

To all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the letters patent granted John B. Newbrough, dated January 19th, 1869, 85927, for improved mode of mounting artificial teeth.

In testimony whereof I, R. H. Duell, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this fifteenth day of August, in the year of our Lord one thousand eight hundred and seventy-six, and of the Independence of the United States the one hundred and first.

{ SEAL PATENT OFFICE } R. H. DUELL,
{ UNITED STATES OF AMERICA. } *Commissioner.*

No. 85927.

THE UNITED STATES OF AMERICA.

(Vignette.)

To all to whom these letters patent shall come:

Whereas Robert Haering, of Melrose, New York, has alleged that
357 he has invented a new and useful improved mode of mounting artificial teeth, (he having assigned his right, title, and interest in said invention to John B. Newbrough, of New York, New York,) and has made oath that he is a citizen of the United States, and that he verily believes he is the original and first inventor or discoverer of the said invention, and that the same hath not, to his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty-five dollars, and presented a petition to the Commissioner of Patents praying that a patent may be issued therefor:

These are, therefore, to grant to the said John B. Newbrough, his executors, administrators, or assigns, for the term of seventeen years, from the nineteenth day of January, one thousand eight hundred and sixty-nine, the full and exclusive right and liberty of making, using, and vending to others to be used, the said invention, a description whereof is given in the annexed schedule and made a part of these presents.

In testimony whereof I have caused these letters to be made patent and the seal of the Patent Office to be hereunto affixed.

Given under my hand at the city of Washington this nineteenth day of January, in the year of our Lord one thousand eight hundred and sixty-nine, and of the Independence of the United States of America the ninety-third.

W. T. OTTO,
Acting Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[L. S.]
ELISHA FOOTE,
Commissioner of Patents.

358 UNITED STATES PATENT OFFICE.

Robert Haering, of Melrose, New York, now residing in Montreal, Canada, assignor to John B. Newbrough, of New York, N. Y. Letters patent, No. 85927, dated January 19th, 1869. Improved mode of mounting artificial teeth.

The schedule referred to in these letters patent, and making part of the same.

To all whom it may concern:

Be it known that I, Robert Haering, of Melrose, Westchester County, New York, now residing in Montreal, Canada, have invented an improvement in mounting artificial teeth; and I do hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to an improvement in securing artificial teeth upon bases or plates of hard or vulcanized rubber or other gum.

In order to enable others skilled in the art to practice my invention, I will now proceed to describe the manner of carrying it into effect.

A plaster cast of the mouth to which the teeth are to be fitted, is first made. A coating of wax, corresponding in shape and thickness to the "base" required, is then applied to the cast and round the bases of the teeth, which are thus held in their proper position.

The teeth and base are now covered with plaster, which is applied in a soft state, but soon hardens, forming the second division of a mould, the other part of which is the cast first made.

359 After the portion of the mold last made has hardened the two divisions are separated, the wax is removed, and prepared rubber is substituted for the same, the sections of the mold being brought together so as to force the gum into all the interstices formerly occupied by the wax.

The mold is then placed in an oven and subjected to heat for such a length of time as may be necessary to harden the gum.

When the operation is complete the plaster is broken away and the teeth will be found securely "set" or "mounted" on a base of gum, which is hard, tough, corresponds in shape to the wax base first made, and possesses many advantages over bases made of ordinary materials.

Without here claiming broadly the application of hard rubber or gum as a base for artificial teeth,

I claim as my invention, and desire to secure by letters patent—

Artificial teeth having gum bases, to which the teeth are secured, as described—that is, by "setting" the teeth in prepared gum on a mold, embedding the whole in plaster, and hardening the gum by the application of heat.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ROBERT HAERING.

Witnesses:
SAM. JOHN STORRS.
JOHN A. FOSTER.

360 *Defendants' Exhibit No. 5.—J. A. S., Ex'r.*

(65.)

DEPARTMENT OF THE INTERIOR.

(Vignette.)

U. S. PATENT OFFICE.

To all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the letters patent granted Charles Goodyear, dated June 15th, 1844, No. 3633, for impt. in India-rubber fabrics.

In testimony whereof I, R. H. Duell, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this seventeenth day of August, in the year of our Lord one thousand eight hundred and seventy-six, and of the Independence of the United States the one hundred and first.

{ SEAL PATENT OFFICE UNITED STATES OF AMERICA. }

R. H. DUELL,
Commissioner.

No. 3633.

The United States of America to all to whom these letters patent shall come:

Whereas Charles Goodyear, New York, has alleged that he has invented a new and useful Improvement in India-Rubber Fabrics,
361 which he states has not been known or used before his application; has made oath that he is a citizen of the United States; that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are, therefore, to grant, according to law, to the said Charles Goodyear, his heirs, administrators, or assigns, for the term of fourteen years from the fifteenth day of June, one thousand eight hundred and forty-four, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Charles Goodyear in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand at the city of Washington this fifteenth day of June, in the year of our Lord one thousand eight hundred and forty-four, and of the Independence of the United States of America the sixty-eighth.

J. C. CALHOUN,
Secretary of the State.

Countersigned and sealed with the *the* seal of the Patent Office.

[L. S.]

HENRY L. ELLSWORTH,
Commissioner of Patents.

362 The schedule referred to in these letters patent and making part of the same.

To all whom it may concern:

Be it known that I, Charles Goodyear, of the city of New York, in the State of New York, have invented certain new and useful improvements in the manner of preparing fabrics of caoutchouc or India rubber, and I do hereby declare that the following is a full and exact description thereof:

My principal improvement consists in the combining of sulphur and white lead with the India rubber, and in the submitting of the compound thus formed to the action of heat at a regulated temperature, by which combination and exposure to heat it will be so far altered in its qualities as not to become softened by the action of the solar ray or of artificial heat, at a temperature below that to which it was submitted in its preparation, say to a heat of 270° of Fahrenheit's scale, nor will it be injuriously affected by exposure to cold; it will also resist the action of the expressed oils, and that likewise of spirits of turpentine or of the other essential oils, at common temperatures, which oils are its usual solvents.

The articles which I combine with the India rubber in forming my improved fabric are sulphur and white lead, which materials may be employed in varying proportions; but that which I have found to answer best, and to which it is desirable to approximate in forming the compound, is the following:

I take twenty-five parts of India rubber, five parts of sulphur, and seven parts of white lead; the India rubber I usually dissolve in spirits of turpentine or other essential oil; and the white lead and sulphur, also, I grind in spirits of turpentine, in the ordinary way of
363 grinding paint. These three articles, thus prepared, may, when it is intended to form a sheet by itself, be evenly spread upon any smooth surface, or upon glazed cloth, from which it may be readily separated; but I prefer to use for this purpose the cloth made according to the present specification, as the compound, spread upon this article, separates therefrom more cleanly than from any other. Instead of dissolving the India rubber in the manner above set forth, the sulphur and white lead, prepared by grinding as above directed, may be incorporated with the substance of the India rubber, by the aid of heated cylinders or callender rollers, by which it may be brought into sheets of any required thickness; or it may be applied so as to adhere to the surface of cloth or of leather of various kinds. This mode of reducing and of applying the sheet caoutchouc by means of rollers is well known to manufacturers.

To destroy the odor of the sulphur in fabrics thus prepared, I wash the surface with a solution of potash or with vinegar, or with a small portion of essential oil, or other solvent of sulphur.

When the India rubber is spread upon the firmer kinds of cloth, or of leather, it is subject to peel therefrom by a moderate degree of force, the gum letting go the fibre by which the two are held together.

I have, therefore, devised another improvement in this manufacture, by which this tendency is in a great measure corrected, and by which, also, the sheet gum, when not attached to cloth or leather, is better adapted to a variety of purposes than when not prepared by this improved mode, which is as follows: After laying a coat of the gum, compounded as above set forth, on any suitable fabric, I cover it with a bat of cotton wool as it is delivered from the doffer of a carding machine,

and this bat I cover with another coat of the gum; a process
364 which may be repeated two or three times, according to the required thickness of the goods. A very thin and strong fabric may be thus produced, which may be used in lieu of paper for the covering of boxes, books, or other articles.

When this compound of India rubber, sulphur, and white lead, whether to be used alone in the state of the sheets or applied to the surface of any other fabric, has been fully dried, either in a heated room or by exposure to the sun and air, the goods are to be subjected to the action of a high degree of temperature, which will admit of considerable variation, say from 212° to 350 degrees of Fahrenheit's thermometer, but, for the best effect, approaching as nearly as may be to 270°.

This heating may be effected by running the fabrics over a heated cylinder, but I prefer to expose them to an atmosphere of the proper temperature, which may be best done by the aid of an oven properly constructed, with openings through which the sheets or web may be passed by means of suitable rollers. When this process is performed upon a fabric consisting of the above-named compound, it must be allowed to remain upon the cloth on which it is made, in order to sustain it, as it is so far softened during the operation as not to be capable of supporting its own weight without such aid. If the exposure be to a temperature exceeding 270°, it must continue for a very brief period.

Having thus fully described the nature of the process by which I prepare my improved India-rubber fabric, I do hereby declare that I do not now claim the combining of sulphur with caoutchouc, either in the proportion named or in any other, this combination having been the subject of a patent granted to me on the 24th of February, 1839; but I do
365 claim the combining of the said gum with sulphur and with white lead, so as to form a triple compound, either in the proportions herein named or in any other within such limits as will produce a like result; and I will here remark, that although I have obtained the best results from the carbonate of lead, other salts of lead, or the oxides of that metal, may be substituted therefor, and will produce a good effect. I, therefore, under this head, claim the employment of either of the oxides or salts of lead, in the place of the white lead in the above-named compound.

I also claim the formation of a fabric of the India rubber by interposing layers of cotton batting between those of the gum, in the manner and for the purpose above described.

I likewise claim, in combination with the foregoing, the process of exposing the India-rubber fabric to the action of a high degree of heat, such as is herein specified, by means of which my improved compound is effectually changed in its properties so as to protect it from decomposition or deterioration by the action of those agents which have heretofore been found to produce that effect upon India-rubber goods.

CHARLES GOODYEAR.

Witnesses:
THOS. P. JONES,
B. K. MORSELL.

Exd.—L. P. H.
REC. 326—17

366 *Defendants' Exhibit No. 6.—J. A. S., Exr.*

(65.)

THE U. S. PATENT OFFICE.

(Vignette.)

To all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the reissue letters patent granted Charles Goodyear, dated December 25th, 1849, No. 156, for impt. in processes for the manufacture of India rubber.

In testimony whereof I, R. H. Duell, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed, this seventeenth day of August, in the year of our Lord one thousand eight hundred and seventy-six, and of the Independence of the United States the one hundredth.

[SEAL OF PATENT OFFICE UNITED STATES OF AMERICA.]

R. H. DUELL,
Commissioner.

Reissue No. 156.

The United States of America, to all to whom these letters patent shall come:

Whereas Charles Goodyear, of New Haven, Conn., has alleged that he has invented a new and useful improvement in processes for the manufacture of India rubber, (for which letters patent were issued to him dated June 15th, 1844, and said letters having been surren-
367 dered by him on account of a defective specification, and that separate letters patent may be granted for the aforesaid improvement, the same have been canceled and separate letters patent ordered to issue to him, on two amended specifications, one for the aforesaid improvement, and another of even date herewith for an "improvement in felting India rubber with cotton fiber,") which he states has not been known or used before his application; has made oath that he is a citizen of the United States; that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of fifteen dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are, therefore, to grant, according to law, to the said Charles Goodyear, his heirs, administrators, or assigns, for the term of fourteen years from the said fifteenth day of June, one thousand eight hundred and forty-four, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Goodyear in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand at the city of Washington this twenty-fifth day of December, in the year of our Lord one thousand eight hun-

368 dred and forty-nine, and of the Independence of the United States of America the seventy-fourth.

T. EWING,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[L. S.] THOS. EWBANK,
Commissioner of Patents.

The schedule referred to in these letters patent, and making part of the same.

To all to whom these presents shall come:

Be it known that I, Charles Goodyear, now of the city and county of New Haven, and State of Connecticut, have invented certain new and useful improvements in the manner of preparing fabrics of caoutchouc, or India rubber, and that the following is a full, clear and exact description of the principle or character which distinguishes them from all other things before known, and of the manner of making, compounding, and using the same.

Caoutchouc, or India rubber, which possesses so many valuable properties in the arts, is in its native state useless for many of the most important purposes for which it might be used, for the reason that it will become soft and sticky, and finally dissolve under the action of a moderate degree of heat, and its other solvents, and as this substance also hardens and softens within the range of different temperatures of the atmosphere, it is ill adapted to most of the manufacturing pur-
369 poses. But as it is elastic and water-proof as well as durable in a high degree, its introduction into a more common use for manufacturing purposes was deemed of great importance.

This led the subscriber to apply all the time and means he could command, and to persevere in his exertions to discover some method of preparing India rubber by which its melting or softening property should be removed, neutralized or destroyed, and its good qualities be retained; seeing the great importance of this object I early and earnestly directed my attention to it.

By the use of acid solutions, a process for which I obtained letters patent bearing date the 17th day of June, 1837, I obtained a partial result bearing on my grand object, but not sufficient to render it of general practical utility.

Subsequently it was discovered that the presence of sulphur in the preparation and treatment of India rubber had some effect to improve its qualities for certain purposes, and for this I, as assignee of Nathaniel Hayward, obtained letters patent bearing date the 24th day of February, 1839.

The leading object of my exertions was to render India rubber capable of resisting the action of heat and cold within the ranges of atmospheric temperature. In reflecting on this subject I became impressed with the idea that in the process of preparation of India rubber it might be beneficially treated with heat at some degree beyond the highest degree of temperature in which the fabric would be used or exposed, and that such treatment might so change and alter it as to cause it to resist successfully all changes of temperature below that under which it was prepared.

370 To this end I instituted and carried on a series of experiments, and finally accomplished the desired end, viz, that of rendering

caoutchouc or India rubber proof against the action of heat and cold below the temperature under which it is cured, and also for all practical purposes against the action of all its known solvents.

But as this substance when subjected to heat by itself could not be cured or deprived of its sticky or soluble properties, I was led to experiment upon it in connection with other substances, and found that when subjected to the action of a high degree of artificial heat in connection with some other substance or substances I could affect this important object. When compounded with sulphur by the application of a high degree of artificial heat I obtained good results, and when compounded with sulphur and the carbonate of lead I obtained the best results, but I found during my experiments with numerous substances that whatever substance or substances be used in connection with the India rubber, the grand result sought after could not be obtained without the action of a high degree of heat artificial heat, which is the great agent in my method of curing.

In view of the peculiar properties of this substance, and the objects to be gained, the nature of the first part of my invention consists in curing caoutchouc or India rubber when combined with or the presence of sulphur by submitting the same to the action of a high degree of artificial heat, at a temperature above solar heat, say, from 212° to 350°, or thereabouts, whereby this substance becomes so changed in its properties as to resist without material change the variations of temperature below that under which it is cured, and also the action of the expressed and essential oils and its other known solvents.

And the second part of my invention consists in preparing and
371 curing the triple compound of caoutchouc or India rubber, sulphur, and a carbonate, or other salt, or oxide of lead for the purposes above pointed out.

To enable others skilled in the arts most nearly allied to this to prepare caoutchouc or India rubber after my improved plan, I will here describe the mode of procedure by which I have been enabled to obtain the best results.

The articles which I combine with the India rubber in forming my improved fabric are sulphur and white lead, which materials may be employed in varying proportions, but that which I have found to answer best, and to which it is desirable to approximate in forming the compound, is as follows:

I take twenty-five parts by weight of India rubber, five parts of sulphur, and seven parts of white lead. The India rubber I usually dissolve in spirits of turpentine, or other essential oils, and the white lead and sulphur, also, I grind in the ordinary way of grinding paint. These three articles when thus prepared may, when it is desired to form a sheet by itself, be evenly spread upon any smooth surface, or upon glazed cloth, from which it may be readily separated, but I prefer to use for this purpose the cloth made according to the present specification, as the compound spread upon this article separates therefrom more cleanly than from any other. Instead of dissolving the India rubber in the manner above set forth, and the sulphur and white lead prepared as above directed, they may be incorporated with the substance of the India rubber by the aid of heated cylinders, or calendar rollers, by which it may be brought into sheets of any required thickness, or it may be applied so as to adhere to the surface of cloth, or of leather of various kinds. This mode of applying and producing the sheet caoutchouc by means of rollers is well known to manufacturers. To destroy the odor of sul-
372 phur in fabrics thus prepared I wash the surface with a solution of

potash, or with vinegar, or with a small portion of essential oil, or other solvent of sulphur.

When the India rubber is spread upon the firmer kinds of cloth, or of leather, it is subject to peel therefrom, by a moderate degree of force, the gum letting go the fibre by which the two are held together. I have therefore devised another improvement in the manufacture not herein claimed, by which this tendency is in a great measure corrected, and by which, also, the sheet gum, when not attached to the cloth or leather, is better adapted to a variety of purposes than when not prepared by this improved mode, which is as follows:

After laying a coat of gum compounded as above set forth on any suitable fabric, I cover it with a bat of cotton-wool as it is delivered from the doffer of a carding machine, and this bat I cover with another coat of gum, a process which may be repeated two or three times, according to the required thickness of the goods.

When this compound of India rubber, sulphur and white lead, whether to be used alone in the state of sheets, or applied to the surface of any other fabric, has fully dried, either in a heated room or by exposure to the sun and air, the goods are to be subjected to the action of a high degree of artificial heat, which will admit of considerable variation according to the thickness and previous preparation of the articles to be treated, say from 212° to 350° of Fahrenheit's thermometer, but for the best effect approaching as near as may be to 270° as a general rule, the usual kinds of fabric should be exposed to this artificial heat from two to six hours, dependent on the thickness of the sheet of gum, and the proportions of the compound. The greater the proportion of lead in the compound employed usually the shorter time required to cure it.

373 The temperature should be gradually raised to the maximum to avoid blistering. The operator should from time to time examine the goods while under treatment to ascertain whether they have been sufficiently cured, and should be careful to avoid the blistering which will frequently take place if the heat be applied too suddenly.

This heating process may be effected by running the fabric over a heated cylinder, but I prefer to expose them to an atmosphere of artificial heat of the proper temperature, which may be best done by the aid of an oven properly constructed, and when for cloths with openings through the sides of which the sheets of India rubber or web of cloth may be passed by means of suitable rollers, but the operator may communicate the heat in any suitable manner or form.

When this process is performed upon the above compound it must be allowed to remain upon the cloth upon which it is placed in order to sustain it, as the compound so far softens during the operation as not to be capable of supporting its weight without such aid. If the exposure be to a temperature exceeding 270°, it must continue for a very brief period.

Any other mode of reducing and dissolving the India rubber and compounding it with the other substances may be substituted for that above described, and although I have described the compound as consisting of India rubber, sulphur and white lead, I do not mean to limit myself to this compound when a high degree of artificial heat is used, as good results may be, and have been, obtained by me by dispensing with the lead, and it is immaterial, so far as regards the principle of my invention, whether the sulphur is incorporated with the India rubber by admixture in the solid form, or spread on the surface thereof, or combined therewith in the gaseous or other form previous to, or during, the process of curing by heat.

374 The leading feature of my invention, and that which chiefly constitutes the substance or essence of its usefulness, is the discovery of the effects produced on India rubber by the action of artificial heat at a temperature above that to which the fabric would be exposed in ordinary or common use.

Although I have above only described the mode of preparing and curing sheets of India rubber, it will be obvious that my method of curing is applicable to articles of any desired form.

What I claim as my invention and desire to secure by letters patent is the curing of caoutchouc or India rubber by subjecting it to the action of a high degree of artificial heat, substantially as herein described and for the purpose specified.

And I also claim the preparing and curing the compound of India rubber, sulphur, and a carbonate or other salt or oxide of lead by subjecting the same to the action of artificial heat, substantially as herein described.

CHARLES GOODYEAR.

Witnesses:
WILLIAM JUDSON.
SETH P. STAPLES.
CH'S M. KELLER.

Ex.—J. A. W.

375 *Defendants' Exhibit No. 7.—J. A. S., Ex'r.*

(65.)

THE U. S. PATENT OFFICE.

(Vignette.)

To all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the reissue letters patent granted Charles Goodyear, dated December 25th, 1849, No. 157, for imp't in felting India rubber with cotton fiber.

In testimony whereof I, R. H. Duell, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this seventeenth day of August, in the year of our Lord one thousand eight hundred and seventy-six, and of the Independence of the United States the one hundredth.

[SEAL PATENT OFFICE UNITED STATES OF AMERICA.]

R. H. DUELL,
Commissioner.

Reissue No. 157.

The United States of America to all to whom these letters patent shall come:

Whereas Charles Goodyear, of New Haven, Conn., has alleged that he has invented a new and useful improvement in felting India rubber with cotton fibre, for which letters patent were issued to him dated
376 June 15th, 1844, and said letters having been surrendered by him on account of a defective specification, and that separate letters patent may be granted for the aforesaid improvement, the same have

been canceled and separate letters patent ordered to issue to him on two amended specifications, one for the aforesaid improvement, and another, of even date herewith, for an "improvement in processes for the manufacture of India rubber." which he states has not been known or used before his application; has made oath that he is a citizen of the United States; that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of fifteen dollars, and presented a petition to the Commissioner of Patents signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose.

These are therefore to grant, according to law, to the said Charles Goodyear, his heirs, administrators or assigns, for the term of fourteen years from the said fifteenth day of June, one thousand eight hundred and forty-four, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Goodyear in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent and the seal of the Patent Office has been hereunto affixed.

Given under my hand at the city of Washington this twenty-
377 fifth day of December, in the year of our Lord one thousand eight hundred and forty-nine, and of the Independence of the United States of America the seventy-fourth.

T. EWING,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[L. S.]
THO'S EWBANK,
Commissioner of Patents.

The schedule referred to in these letters patent and making part of the same.

To all to whom these presents shall come:

Be it known that I, Charles Goodyear, of the city and county of New Haven, State of Connecticut, have invented a certain new and useful fabric, which I denominate India-rubber vellum, and that the following is a full, clear, and exact description of the principle or character which distinguishes it from all other things before known, and of the method of making, compounding, and using the same.

It has long been essayed to combine the fibres of cotton or other fibrous substance or substances with sheets of India rubber or the compounds thereof, with a view to make a thin fabric, possessing lightness, strength, and durability, but until my present invention these attempts have not been attended with any marked success.

The method heretofore practised or essayed were, first, to grind
378 or mix together the fibres of cotton or other substance and the India rubber, and then forming it into sheets by passing the mass between callender rollers, in the manner of making sheet india rubber.

Secondly, after making a sheet of India-rubber or its compounds, coating the surface with flakes of fibrous substance or substances, again rolling, then another coating of flakes, and so on, until the required thickness was obtained—and thirdly, to cement a coating of India-rubber on to cotton or other bats. The first and second of these methods

are defective for the reason that in the operation of grinding or mixing and drawing between the callendering rollers to obtain the thickness of sheet required, the fibres are necessarily broken up and thus lose their strength, so that the fabric thus produced actually possesses no more, if as much, strength as if made of India-rubber alone or any of its compounds. And the third gives too much thickness and but little strength, for the bat of fibres in itself possesses comparatively but little strength, and when cemented to the sheet of India-rubber, the two are only connected along their contiguous surfaces, and the India-rubber will therefore be strengthened only by the fibres in actual contact with it.

My invention consists in combining the fibres of cotton or other substance with a sheet of caoutchouc or India-rubber prepared in any desired manner by laying a bat or fleece of cotton or other fibrous substance on to a previously prepared sheet of India-rubber or caoutchouc of the required thickness and in the green state as it is termed—that is, before the India-rubber has been subjected to the curing process, and then pressing the fibres of the fleece into the gum by subjecting the whole to the requisite pressure, whilst the sheet of gum is in a soft state.

379 The mode of procedure which I have practiced with success is to take a sheet of India-rubber prepared after the manner secured to me by letters patent, bearing date the 15th day of June, 1844, and of about the thickness of the intended fabric, and whilst it is in what is called the green state, this is rolled on to a beam with a sheet of cotton or other cloth interposed to prevent the surfaces of the rubber from adhering. The beam thus prepared is placed on appropriate bearings near the usual callendering rollers. A thin fleece or bat of cotton or other fibrous substances is in like manner rolled up on a beam and also mounted near the callendering rollers. One end of the sheet of India-rubber, without the cloth, and one end of the fleece or bat of fibres are put together in the bight of the callendering rollers, and thus, one on the other, rolled through, the rollers being so adjusted as to press and force the fibres of the bat or fleece into the sheet of India-rubber, or so much of them as the India-rubber will receive, and the surplus, if any, is then to be stripped or rubbed off.

Instead of this the sheet of India-rubber can be formed at the same operation by having a series of callendering rollers, say four, one above the other. The mass of India-rubber taken from the grinding machine, is applied between the top and second rollers, and formed into a sheet, which from this passes between the second and third rollers, where it is reduced to the required thickness. Thence it passes to the bight of the third and fourth rollers, where the bat or fleece of cotton or other fibrous substance is introduced with it to be incorporated as above described.

In either of these ways the fibres are thoroughly incorporated with the India-rubber, and being carried through between the rollers but once, or if more than once, without materially stretching the sheet, the fibres retain their tenacity, and being cemented or agglutinated

380 by the gum or India-rubber produce a fabric of great strength and with but little or no elasticity, and with a surface entirely different from any other fabric heretofore known. The degree of thinness within which such a fabric can be produced is only limited by the thickness of the fibres, for the sheet of India-rubber may be so thin as to receive only one or two ranges of fibres, not attached to the surface of the India-rubber but imbedded in it. A fabric, however, so thin as this, would be of but little practical utility, and would require a nicety

of mechanical adjustment in the callendering rollers not well adapted to practical purposes, and this is merely stated to give a clear notion of the character of the fabric produced by my invention.

After the fabric has been thus prepared it may be subjected to any of the cooling processes.

It will be obvious from the foregoing that small sheets of this fabric can be made in any kind of platen-press by the application of direct pressure to incorporate the fibres of the fleece or bat with the sheet of India-rubber, and that, instead of preparing the fleece or bat of fibrous substance separately it may be formed directly on the sheet of India-rubber, for such variations will not, in any manner, vary the principle or character of my invention, which, as previously stated, consists in forcing the fibres of the fleece or bat into the prepared sheet of India-rubber, without subjecting them to a stretching operation after they have been incorporated, and thus retaining their full strength in addition to the strength due to the India-rubber; and, therefore, it will be obvious that this can be effected by any mechanical means which will not materially injure the fibres.

What I claim as new and of my invention is incorporating the fibres of cotton or other substance with India-rubber by pressing the fibres of a fleece or bat of cotton or other fibrous substance into a sheet of
381 India-rubber in the green state without subjecting the fibres, after they have been incorporated, to a stretching or a drawing operation, substantially as herein described.

CHARLES GOODYEAR.

Witnesses:
BENJ'N S. MALLETT,
ALFRED ROE.

Ex.—J. A. W.

Defendants' Exhibit No. 8.—J. A. S., Ex'r.

(65.)

DEPARTMENT OF THE INTERIOR.

(Vignette.)

U. S. PATENT OFFICE.

To all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the bound volumes of the library of this office of the specification in the matter of English letters patent, granted Thomas Hancock, dated March 18th, 1846, No. 11135.

In testimony whereof, I, R. H. Duell, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this
382 seventeenth day of August, in the year of our Lord one thousand eight hundred and seventy-six, and of the Independence of the United States the one hundred and first.

{ SEAL PATENT OFFICE UNITED STATES OF AMERICA. }

R. H. DUELL,
Commissioner.

A. D. 1846. No. 11135. Manufacture of articles of India-rubber.

HANCOCK'S SPECIFICATION.

To all to whom these presents shall come I, Thomas Hancock, of Marlborough Cottage, Stoke Newington, in the county of Middlesex, esquire, send greeting:

Whereas Her present Majesty, Queen Victoria, by her letters patent under the great seal of the United Kingdom of Great Britain and Ireland, bearing date at Westminister, the eighteenth day of March now last past, did give and grant unto me, the said Thomas Hancock, her especial license, full power, sole privilege and authority, that I, the said Thomas Hancock, my executors, administrators, and assigns, or such others as I, the said Thomas Hancock, my executors, administrators, or assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term of years therein expressed, should and lawfully might make, use, exercise, and vend,
383 within England, Wales, and the town of Berwick-upon-Tweed, my invention of "improvements in the manufacturing and treating of articles made of caoutchouc, either alone or in combination with other substances, and in the means used or employed in their manufacture," in which said letters patent there is contained a proviso obliging me, the said Thomas Hancock, by an instrument in writing under my hand and seal, particularly to describe and ascertain the nature of my said invention, and in what manner the same is to be performed, and to cause the same to be enrolled in Her said Majesty's high court of chancery within six calendar months next, and immediately after the date of the said letters patent, as in and by the same, reference being thereunto had, will more fully appear.

Now know ye, that in compliance with the said proviso, I, the said Thomas Hancock, do hereby declare the nature of my said invention, and the manner in which the same is to be performed, is particularly described and ascertained in and by the following description thereof (that is to say):

My improvements consist in manufacturing articles made of caoutchouc, either alone or in combination with other substances; also in forming and giving to such articles specific and permanent shapes or forms; also in producing a perforated, perflable, or vesicular manufacture; and also in certain compounds of caoutchouc with other substances.

I would first premise that in all the compounds and most of the articles comprised in this specification I employ sulphur and heat, as described in the specification of my patent of November twenty-first, one thousand eight hundred and forty-three, which process is now commonly designated vulcanizing, and I shall, for brevity sake, use that
384 term in this specification, whether it is applied to the whole process described in my said specification, or only to the completion thereof by heat when sulphur has already been introduced into the compound; and by the term compound I wish to be understood always to mean any of the combinations comprehended in this specification that may be severally most suitable for each purpose.

When I manufacture these compounds into articles requiring to be of a permanent shape or form, I make such articles in or upon forms, molds, plates, or engraved surfaces or patterns, by pressing, fitting, placing, or molding such compounds, previously prepared in sheets or

otherwise, in or upon such molds or forms, and allowing the articles to remain there whilst exposed to the vulcanizing process, which effectually sets them permanently to the respective forms. In order to prevent adhesion to the mould I employ silicate of magnesia, either by dusting it on in the form of a powder, or with a brush when mixed with water applied either to the mold or the compounds, as may be most desirable. In some cases I find it convenient to remove the articles from the moulds before vulcanizing, in which case I submit them for a short time before removal to a temperature of from 220° to 300° according to the size or bulk of the article, for which purpose I prefer a water or steam bath under sufficient pressure to produce the required heat. When cold I remove them from the molds, and afterwards vulcanize them to make their forms permanent. The same process of obtaining ornamental surfaces by molds may be resorted to with advantage when caoutchouc without the process of vulcanization is employed. For some articles that are not of much bulk I take sheets composed of caoutchouc only, and obtain impressions from moulds in manner just mentioned in respect of compound sheets which I remove from the molds, and then apply a thin solution of the caoutchouc, containing a large proportion of sulphur to the surfaces of such articles, [or I rub dry powdered sulphur upon them or immerse them in a sulphur bath and then vulcanize them, 385 or I saturate any suitable solvent of caoutchouc with sulphur and apply successive coatings to these articles, and when dry vulcanize them. The same proceeding may be followed in making similar articles in molds from solutions of caoutchouc only. If the solvent employed is previously sufficiently saturated with sulphur at a temperature of from 300° to 320°, these articles will be sufficiently vulcanized for some purposes without carrying the process further, but I prefer applying heat afterwards. I sometimes employ a solution of caoutchouc, or caoutchouc softened to the consistence of dough by the addition of a small quantity of solvent, as described in the specification of my patent of April, one thousand eight hundred and thirty-seven (blending or mixing sulphur therewith). I pour the solution or press the dough into molds, forms, or patterns, and allow them to dry and then vulcanize them. The thinner solutions answer well for hollow molds into which I pour a sufficient quantity to cover all the parts, I then allow the solution to drain out, and place the mould in a stove or warm room, and when this first coat is dry I repeat the operation until the desired thickness is obtained, and when perfectly dry I vulcanize them. If necessary the molds may be made in parts, as is well known and understood. In some cases I make the figures in or on parts of molds, and then cement the parts together, and replace the entire figure in or on the molds and vulcanize it. In some cases I make the first coating with the solution, and then thicken up parts or the whole with dough prepared as before mentioned. Instead of the foregoing, I sometimes make these figures of the compound, prepared in sheets of any desired thickness, and join them up to the form of the mold. When for an internal figure, the opening being secured, I apply internal pressure, by admitting through a stop-cock steam or air, or by any other convenient mode so as to obtain the requisite pressure to bring up the pattern, and con- 386 tinue such pressure during the process of vulcanizing. Instead of steam or air, I sometimes fill the interior of the hollow figure with mercury, or any metal that will fuse at the temperature employed in vulcanizing the article; as the pressure in these cases is obtained, simply by the weight of the metal, the sheet of compound forming the hollow figure, should be proportionably thin.

It is generally necessary to make small holes in the mold for the escape of air from between the mold and the article or figure. In cases where great pressure can be applied I find that in shaping the figure before it is put into the mold an approximation only is required to the form of the mold, the heat and pressure being sufficient to bring up the finer parts. Bottles and other vessels of capacity I make in the same way. These hollow molds require to be made strong in proportion to the size of the work, and the required internal pressure. Casts from flat molds, such as bas-reliefs and engraving, I also sometimes make of sheet compound, and force it into the molds by heat and pressure, and then vulcanize them. This mode, amongst other uses, is particularly applicable to produce printing surfaces. I press the material into the mold with screw cramps, or by presses, or other well known means. These or any other convenient modes may be adopted. I mention these as examples sufficient to shew the workman what is my design, and how it may be carried out; I raise figures on or emboss cylindrical and other similar forms or articles by engraving or otherwise, producing raised or sunken designs on the external surface of cylindrical molds. I then form tubes of the sheet compound of such a size as will draw closely on the mold. I then wind very tightly over the whole, a strip of cotton or linen cloth, so as to produce sufficient pressure to obtain the impression, or the requisite pressure may be applied by any other convenient means, and I then vulcanize them, and when the article is withdrawn from the mold I turn it inside out, which brings the pattern to the outside. I
387 find that impressions perfect enough for some purposes may be obtained on sheets of the compound, and sufficiently set for vulcanizing by means of engraved rollers heated to about 240°. The pressure must be as light as the nature of the article will allow, and the motion of the rollers slow, and I prefer them of large diameter. When I wish to prevent extensibility in any of these articles I either mix fibrous matters with the compound, or I attach, by means of the sulphured solution before mentioned, previously to vulcanizing any suitable fabric, preferring cotton or linen. For some of the purposes to which the compound is applied it is desirable that articles formed of it should be so manufactured as to admit of air or perspiration passing through it. To effect this in sheets or articles made of the compound that are not very thick I take out by means of hollow punches of any required form as much of the substance as the case requires, and I do this either before or after vulcanizing, but I prefer the former. Instead of punching I sometimes make incisions in the articles, and keep these incisions a little on the strain or open in the required direction during the process of vulcanizing, or I otherwise puncture the sheet or article, and follow the same treatment. The punching, incising, or puncturing, may be done by hand or by machinery, the chief care being required in preventing any closing of the openings during the vulcanizing process. If the articles are ornamented by embossing, and it is desirable to conceal or obviate the appearance of these perforations I form my design for such ornament so as that the openings may form part of such design. If it is wished to make any part of an article weaker at certain points I find perforating or punching out the mateial a convenient mode of effecting this object to any required degree; the parts so weakened will be less liable to tear out if the perforations are made previously to vulcanizing. If, for any purpose, it is required that the sheets or articles should be punctured to a certain depth, but not through, I take two sheets,
388 one punctured and the other plain, and unite them face to face before I vulcanize them. If, for any purpose, articles require

either to be sewn together or to any other material, I make the compound thicker in the part where the needle is to pass, or, previously to vulcanizing, I place or insert a strip of cotton or linen coated with solution upon or between them.

For low-priced articles I sometimes combine caoutchouc and sulphur with vegetable or stockholm pitch, and when spread into sheets or made up into other forms I vulcanize the compound. The proportions may be varied very considerably, as well as the temperatures at which they are vulcanized, but I find the following to answer well: 8 parts caoutchouc, 2 sulphur, 3 pitch; or 8 parts caoutchouc, 2 sulphur, 1 pitch; submitted to a temperature of 290° for an hour to prevent blistering and porosity. If necessary I employ pressure by means of screw cramps and plates or otherwise during the vulcanizing. This material is applicable to railway packing and other rough uses. I also combine and vulcanize in the same manner caoutchouc, sulphur, and resins, preferring on account of its cheapness the common resin of commerce. The proportions and temperature as in the case of pitch may be varied, but the following I find to be useful for many purposes: 16 parts caoutchouch, 2 parts sulphur, 6 parts resin; or 16 caoutchouc, 4 sulphur, 2 resin. These compounds may be submitted to the same treatment as in the case of pitch, and are applicable to similar uses. For some purposes I also combine caoutchouc and sulphur with wood or cork dust, or fibrous substances, such as hemp and flax, or any other suitable material cut into short lengths, and vulcanize such compounds either in blocks or spread, or otherwise wrought into sheets or formed into figures, or embossed or ornamented as before described. When it is desirable to obtain from caoutchouc a great amount of elasticity to counteract the collision of great forces or heavy bodies, as in the case of
389 carriage springs, and the buffers of railway carriages, and for other similar purposes, I form the material in such a manner so as to obtain a large amount of divisions or openings so as to expose and bring into action a great extent of moving or movable surface; and I do this either by cutting or otherwise shaping any given quantity of material into parallel or suitable forms, either square, hexagonal or octagonal, or into solid or open hollow cylinders, corrugated sheets or any other suitable forms, and, before vulcanizing, build them up and cement them together, either across each other at right angles, or diagonally or otherwise, always leaving as much space between each as to admit of the free action of the surfaces when compressed. Hollow cylinders or other hollow forms I sometimes cement together, laying them longitudinally side by side, and in either case continue to build up until I obtain the dimensions necessary to produce the required amount of elasticity; similar structural forms may be advantageously applied to other uses. When it is desirable that extensibility in any direction should be prevented, I apply, by cementing on or between some of the layers when building up the structure, linen cloth of suitable strength, coated with the solution as before mentioned. I have in a former part of this specification described a mode of manufacturing figures in strong hollow molds. I pursue the same methods in forming chambers to contain air for resisting pressure and blows when used for carriage springs, buffers and other elastic surfaces for railways, and when stuffing or padding beds, seats, cushions, and other surfaces requiring elasticity. In some cases, such as railway buffers, it may be necessary to make provision against accidental ruptures in these chambers, which may be done by enclosing several, one within another. I effect this by making them in parts with flanges at the points, and after vulcanizing, welting or bolting

the parts together, or in any other convenient way, the sizes of such chambers to be so regulated as to leave sufficient space for the
390 protection of the flanges. When necessary I make apertures for the purpose of inflating these chambers to any required degree in the manner well known in similar manufactures. A series of cylindrical or other forms for containing air may be cemented together and then vulcanized, the openings by which they are to be inflated being left open during the process of vulcanization.

For mattresses, beds, life-preservers, cushions, pads, carriage linings, parts of saddles and horse collars, and other the like purposes, I apply these air-chambers of cylindrical or other forms, by enclosing them in cloth or leather cases divided into compartments to receive them, or in cases of the vulcanized material, either plain or ornamental. I have mentioned in a former part of this specification that I combine pitch, resin, and various other substances with caoutchouc previously to vulcanizing; and I wish now to state that I do this by the means described in my former specifications, to which I would add that, in combining pitch and resin with caoutchouc by mechanical power, I find it useful to introduce water into the machine during the operation. The molds I make of glass; when it can be conveniently applied, tin, type metal, porcelain, and highly vulcanized caoutchouc. They may be made of any other suitable material, but I prefer the above. If for smooth or polished surfaces, I use sheets of plate glass; if for ornamental purposes, I cast them of glass of the required pattern or form.

I have now stated the manner in which I manufacture articles of caoutchouc, either alone or in combination with other substances, the means by which I give permanency of shape or form to such articles, and the compound substances employed in the various manufactures I have mentioned; also, in several instances, the purposes to which the compounds are suited, and modes of application; yet I have done so only by way of example, the modes and compounds being well adapted
391 to a great variety of other articles and purposes, such as embossed fancy articles of dress, bracelets, collars, ornamental edgings and borders, military epaulettes, belts, and other similar articles, imitations of crape and of cord, lace and fringe for coach linings and other purposes. picture and other frames, ornaments for the decoration of cabinet furniture and hangings and draperies, either elastic or attached to cloth.

What I claim as my invention is:

Firstly. The making, forming, or shaping articles from the combinations of caoutchouc with other substances as hereinbefore described, in or upon molds, plates, or forms, and retaining such articles in or upon such molds or forms during the process described in my specification of one thousand eight hundred and forty-three, and now commonly called vulcanizing, whereby the form of such articles is rendered permanent.

Secondly. The making, forming or shaping articles of caoutchouc in or upon engraved or otherwise ornamented plates or molds, and, after forcing the caoutchouc into such molds by pressure and heat, submitting the whole, by means of a water or steam bath or any other suitable mode, to a high temperature, whereby the articles are sufficiently set to be removable from the moulds, and which may be afterwards, if desired, subjected to the vulcanizing process.

Thirdly. The manufacturing articles, by combining caoutchouc with vegetable pitch, resin, wood, and cork dust, and fibrous substances, and subjecting them to the process of vulcanizing.

In witness whereof I, the said Thomas Hancock, have hereunto set

my hand and seal this seventeenth day of September, one thousand eight hundred and forty-six.

THOMAS HANCOCK. [L. S.]

392 And be it remembered that on the seventeenth day of September, in the year above mentioned, the aforesaid Thomas Hancock came before our Lady the Queen, in her chancery, and acknowledged the specification aforesaid, and all and everything therein contained, in form above written. And also the specification aforesaid was stamped according to the tenor of the statute in that case made and provided.

Inrolled the eighteenth day of September, in the year above written.

WM. HORNE.

Ex'd.—L. P. H.

Defendants' Exhibit No. 9.—J. A. S., Ex'r.

(65.)

DEPARTMENT OF THE INTERIOR.

U. S. PATENT OFFICE.

To all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the bound volumes of the library of this office of the specification in the matter of English letters patent granted Charles Hancock, dated May 15th, 1846, No. 11208.

In testimony whereof I, W. H. Doolittle, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this eighteenth day of August, in the year of our Lord one thousand eight hundred and seventy-six, and of the Independence of the United States the one hundredth and first.

[SEAL.]

W. H. DOOLITTLE,
Acting Commissioner.

422 A. D. 1846. No. 11208. Manufacture and application of gutta-percha.

HANCOCK'S SPECIFICATION.

To all to whom these presents shall come, I, Charles Hancock, of Grosvenor Place, in the county of Middlesex, artist, send greeting:

Whereas her present most excellent Queen Victoria, by her letters patent, under the great seal of the United Kingdom of Great Britain and Ireland, bearing date at Westminster, the fifteenth day of May, in the ninth year of her reign, did give and grant unto me, the said Charles Hancock, my executors, administrators, and assigns, her especial license, full power, sole privilege and authority, that I, the said Charles Hancock, my executors, administrators, and assigns, and such others as I, the said Charles Hancock, my executors, administrators, or assigns should at any time agree with, and no others, from time to time and at all times thereafter, during the term of years therein mentioned, should and lawfully might make, use, exercise, and vend, within that part of the United Kingdom of Great Britain and Ireland called England, her dominion of Wales and town of Berwick-upon-Tweed, and also in the Islands of Jersey, Guernsey, Alderney, Sark, and Man, and in all her colonies and planta-

tions abroad, my invention of "certain improvements in the manufacture of gutta-percha and its applications, alone and in combination with other substances;" in which said letters patent is contained a proviso requiring that I, the said Charles Hancock, shall particularly
394 describe and ascertain the nature of my said invention and in what manner the same is to be performed, by an instrument in writing under my hand and seal, to be enrolled in her said Majesty's High Court of Chancery, within six calendar months next and immediately after the date of the said in part recited letters patent, as reference being thereunto had will more fully and at large appear.

Now know ye, that in compliance with the said proviso, I, the said Charles Hancock, do hereby declare that the nature of my invention and the manner in which the same is to be performed, are particularly described and ascertained in and by the present instrument in writing, (that is to say:)

My said invention consists, firstly, in certain improved methods of preparing gutta-percha for manufacturing purposes; gutta-percha, as it is imported into this country, frequently possesses great acidity with a fetid or unpleasant smell, and is generally mixed with other impurities, from which it ought to be cleansed before it can be beneficially applied in the production of many articles of manufacture.

For the purpose of cleansing gutta-percha, it is better that it should first be reduced into small pieces by means of saws, knives or any other means usually adopted for that purpose, and the cutting of lumps of gutta-percha will be very much facilitated by first steeping them in hot water until they are softened. The gutta-percha having been cut into small thin pieces (and the smaller and thinner the better), so as to expose a large extent of surface to the action of the liquid into which it is to be thrown, is then to be immersed in an alkaline solution, or in a solution of chloride of some alkali or earth, in which the gutta-percha must remain until the acid and fetid impurities which it contains have been got rid of or materially diminished, for which purpose it will
395 generally require to be kept in the liquor from about one to four hours, according to the degree of impurity of the article at the time it is thrown into the liquor. I prefer using common soda or potash for forming an alkaline solution, on account of the cheapness of these articles, but if these alkalies are used in a more caustic state they will act more quickly and with greater energy. I prefer also to use the chloride of lime to any of the other chlorides, in consequence of that article being cheaper. The solution is made of the strength that I prefer, by dissolving about one pound of alkali or chloride with ten gallons of water. If it is desired still further to diminish the acidity or smell of gutta-percha, it may in the first place be subjected to the action of an alkaline solution and then to a solution of chloride of lime. Gutta-percha thus prepared may then be subjected to the cleansing process described in the specification of the patent for England, granted to Richard Archibald Brooman on the eleventh day of March, one thousand eight hundred and forty-five, for "certain improvements in the preparation and application of artificial fuels, mastics, and cements," or to any similar process by means of which the gutta-percha may be freed from such of its impurities as can only be separated from it by mechanical means.

Secondly. My invention consists of new modes of giving shape and configuration to articles to be made of gutta-percha and its compounds in the manufacturing of such articles, and also of new modes of ornamenting such articles of manufacture. The compounds of gutta-percha

most applicable for this purpose are to be produced by mixing gutta-percha with caoutchouc and jintawan, or either of them, and thoroughly blending the several materials into one homogeneous mass, in the manner described in my specification of my invention comprised in my patent for England, granted to me on the twelfth day of January last, for my invention therein, entitled "certain improvements in the
396 manufacture of gutta-percha and its applications, alone and in combination with other substances, or by adding to the mixtures or compounds aforesaid bronze or other metallic powders, plaster of Paris or other earthy powders pigments, fibrous materials cut up short, paper pulp or dust, or any other suitable materials." The relative proportions of the materials to be combined are to be regulated according to the qualities which the compound article is desired to possess.

Gutta-percha and its compounds, when in a plastic state, may with great facility be molded into almost any form or shape which the manufacturer may wish it to assume, and this may be done by means of molds, patterns, shapes, dies, &c., in manner hereinafter described. Gutta-percha and its compounds, when in a state of solution, may also be applied to molds, patterns, shapes, &c., so that when several layers thereof have been dried upon such molds, and then removed therefrom, articles of manufacture may be obtained of the required shape or configuration, as hereinafter described. So also, in forming articles of several sheets or pieces of gutta-percha or its compounds, the sutures or joints thereof may be softened or made plastic by the application of heat, and joined permanently together by pressure whilst in that state, or such sutures or joints may have gutta-percha or gutta-percha compounds in a state of solution applied thereto, as or by way of cement, and the sutures or joints being kept close until the solution has been dried, the parts will be permanently united together. Excellent molds, forms or shapes may be made of gutta-percha or its compounds for the purpose of being used or applied in giving form, shape or figure to articles to be made of gutta-percha or its compounds, or of such other substances as can be molded at a low temperature. Although several pieces of gutta-percha, or of its aforesaid compounds, have the property when in a warm and soft or plastic state of uniting together and becoming one entire homogeneous mass, yet a piece of gutta-percha, or of any of its said compounds,
397 when in a plastic state, will not adhere to any other piece of gutta-percha, or of any of its said compounds, which is in a cold and rigid, and therefore not in a plastic state.

In order to make a mold, form or shape of gutta-percha, or of any of its compounds, I take a pattern of the article in the production of which the mold, form or shape is intended to be used, and apply gutta-percha or any of its compounds in a warm and soft or plastic state, and either in sheets or in any other convenient form to the pattern, and manipulate or press the gutta-percha or its compounds into, upon or against all the parts of the pattern, so that the intended mold, form or shape may be capable of producing an article in all respects of the shape, form or configuration as the pattern. And when a mold, form or shape is intended to produce an article having a surface covered with figures or projections, as, for instance, the forms of types, wood-cuts, printers' blocks, &c., to be used in printing, I place the pattern in a shallow box or frame, clamped together, of the size of the pattern, and put a sufficient thickness of gutta-percha or gutta-percha compound into or upon the pattern. I then apply pressure by means of a screw-press or other power, whereby I obtain a perfect impression of all the parts. If the

intended mold, form or shape is to be made by means of gutta-percha, or any of its compounds in a state of solution, the pattern must have several coats of the solution spread equally all over it, each coat being effectually dried before a succeeding coat of solution is put on, and such a number of coats of solution must be laid on as will produce a solid covering of the desired thickness. Whether a mold, form or shape of gutta-percha or any of its compounds is made so far by the one or other of the aforesaid modes, it must, if necessary, be strengthened, and that may be done by having a thick coat of gutta-percha, or of some of its compounds in a plastic state, or in a state of thick solution, spread all over it (which ought, if necessary, to be repeated), so as firmly to
398 adhere thereto, and make the mold, form or shape sufficiently firm and strong for the use to which it is to be applied. And if the gutta-percha or any of its compounds is used in a plastic state for the purpose of strengthening a mold, form or shape, after it has become cold and rigid, a small quantity of it in a state of solution may first be applied to the outside of the mold, form or shape, so as to make the plastic gutta-percha or its compound adhere thereto.

A mold, form, or shape, may, however, be strengthened by any other convenient means. The mold, form, or shape having thus been made according to the pattern, it is when cold and dry to be taken off the pattern (either destroying the pattern or otherwise), and, if necessary, parted or cut into several pieces, in the way which is commonly used by persons using molds for casting. If, however, it is necessary that a mold, form, or shape should be in several pieces, it will generally be found better to make it in several pieces by covering only one part of the pattern at a time, in manner before described, so as to make only so much of the required mold, form, or shape at one time as shall be intended to be in one piece, and then to allow such piece to become cool and rigid before the next adjoining piece of the mold, form, or shape is made, by which means the several pieces thereof will be prevented from adhering to each other; and each piece of the mold, form, or shape having been completed by covering the pattern in this manner, the whole of the pieces may with ease be detached from the pattern and from each other.

A mold, form, or shape made as above described will, if carefully made, possess an accurate impression of the pattern from which it has been taken, and will be found a useful mold, form, or shape for the manufacturing of articles to be made of gutta-percha, or its compounds, or of other materials capable of being molded at a low tempera-
399 ture; molds, forms, or shapes for the manufacturing of articles of gutta percha or any of its compounds may, however, also be made of any other fit material, such as metal, glass, wood, or earthenware. The great advantage of using gutta-percha or any of its compounds in the making of molds, forms, or shapes consists in the cheapness and facility with which such molds, forms, or shapes may be made from intricate patterns, and the correct impressions which such molds, forms, and shapes take from the patterns and communicate to articles produced therein. But there is in some cases this disadvantage attending the use of such molds, forms, or shapes in the manufacture of articles to be made of gutta-percha or any of its compounds, that such molds, forms, or shapes cannot be heated or kept in a hot state whilst they are being used, for in such a state they would become plastic, and would lose their proper shape or adhere to the material to be manufactured. It is therefore desirable, whenever a mold, form, or shape, made of metal or any material that can be heated or kept hot whilst in use, will not be

too expensive, that the mold, form, or shape should be formed of such a material. In using molds, forms, or shapes made of such a material in the manufacture of articles to be made of gutta-percha or any of its compounds, in a plastic state, as hereinafter described, it will be found in some cases that the process will be very much facilitated by heating the mold, form, or shape to a temperature somewhat less than that of boiling water, and keeping it as nearly as conveniently may be at that temperature, and the plastic material ought also in every case to be kept as nearly as may be of that temperature until the process is completed, after which the article in the mold, form, or shape must be put aside to cool, so that the manufactured article may set or become cold and rigid. Molds, forms, or shapes made of gutta-percha or any of its compounds in manner hereinbefore described are not only applicable in the manufacture of articles of gutta-percha or any of its compounds, but also in the manufacture of porcelain, earthenware, papier
400 maché, and other articles. In using molds of gutta-percha or any of its compounds, black lead or French chalk may be used as a facing to secure a perfect delivery from the mold in the ordinary way.

In order to make articles of gutta-percha or any of its compounds by means of molds, forms, or shapes, any of the modes I am now about to describe may be adopted. Thus, if any article is to be made of gutta-percha, or any of its compounds, and is intended to be made solid in a close mold, it may be made as follows: The mold, form, or shape ought to have an ingate, through which the material is to be introduced, and also small outgates or air-holes for letting the air out of the mold, form, or shape in the usual way. The mold, form, or shape being made sufficiently strong by a jacket or other sufficient means, the gutta-percha or other material of which the article is to be formed, being in a warm and soft or plastic state, and being placed in a cylinder or any other convenient vessel connected with the ingate, is to be forced out of such vessel through the ingate into the mold, form, or shape by a screw acting against a plunger or any other convenient means. I have found that it is better that the pressure upon the material should not be withdrawn until the contents of the mold, form, or shape have become cold and firm, or rigid, after which the article may be taken out of the mold, form, or shape and finished by the removal of accidental excrescences (if any) as may be necessary. Some articles intended to be made solid may be made in molds, dies, forms, or shapes, which open in two or more parts, by introducing the requisite quantity of plastic gutta-percha or any of its compounds in one or more pieces into the interior of or between the parts of the molds, dies, forms, or shapes, and by then closing, stamping, or pressing the various parts of the molds, dies, forms, or shapes together in such a manner as to impress the material with the intended form or pattern. It will generally be found advisable to introduce a very small surplus of material into the mold, die, form,
401 or shape, and by this means the perfection of the form or pattern to be impressed upon the material will be more effectually secured and the surplus of the material will be pressed out at the joints of the mold, die, form, or shape. In many cases in which pieces of gutta-percha may be introduced or placed into or upon molds, dies, forms, or shapes of nearly the size and shape which they are intended to assume, such pieces may be impressed with the desired shape and figures, patterns, or ornaments by heating the molds, dies, forms, or shapes into or upon which they are to be introduced or placed, and after introducing such pieces in a cold state, pressing the same in the

molds, forms, or shapes, so as to produce the required effect. By adopting this process the body of a piece of gutta-percha will be kept cold or nearly so, and the surface thereof only will be made soft by contact with the heated mold, die, form, or shape so as to be capable of being pressed or stamped into every part of the mold, die, form, or shape into or upon which it has been placed. Many of the compounds of gutta-percha may be treated in the manner just described, but the smaller the quantity of gutta-percha in the compound the less effective will the operation be. If a hollow cast is intended to be made, or an article made with a hollow or vacant space in the interior thereof (in an open mold), such, for instance, as a bust, the interior of the mold, form, or shape may be covered with gutta-percha or any of its compounds in a warm and soft or plastic state, the material being carefully pressed by the hand or any other convenient means into every part of the mold, form, or shape. The perfection of the article to be made will be more effectually secured by forcing hot sand, hot water, or hot air into the interior of the article, and by adopting these or any similar means the material may be forced into every part of the mold, shape, or form, and made to assume the form, shape, or figure which is intended. Hollow articles to be made of gutta-percha or any of its compounds may also be made as follows:

402 I take a strong mold, form, or shape capable of being made air-tight, and made of metal or any other fit material. This mold must have an ingate and an outgate, each provided with a stop-cock; the tube of the stop-cock fitted to the ingate must proceed a short distance within the mold, and the mold ought to be furnished with strong clamps for clamping it together. The piece of gutta-percha, or of any of its compounds which is intended to be manufactured, must be made into a shape as nearly resembling that of the intended article as conveniently may be, but considerably smaller, and having a space in the interior thereof; or the interior thereof so constructed that the same may, by air blown into the interior thereof, be pressed into every part of the mold, form, or shape. The piece of gutta-percha, or any of its compounds, is then to be connected with the tube of the stop-stock fitted to the ingate, and so that the air coming through the ingate may be forced into the interior of the piece of gutta-percha, or of any of its compounds, without communicating with the space between such piece and the mold, form, or shape. The stop-cock of the outgate must be fitted so that it may be made to communicate with an air-pump for exhausting the air out of the mold, form, or shape. A piece of gutta-percha, or of any of its compounds, in a soft and plastic state, being introduced into the mold in the way already described, and the mold having been strongly clamped together and made air-tight (the stop-cock of the ingate being closed), the stop-cock of the outgate is to be opened and made to communicate with an air-pump; the air is then to be exhausted out of the mold, form, or shape by the air-pump, after which the stop cock of the outgate must be closed and that of the ingate opened. The pressure of the air proceeding through the ingate into the interior of the piece of gutta-percha, or such other material as aforesaid, will, in some

403 cases, be sufficient to force the material into every part of the mold, and complete the impression which it is intended to receive; but in those cases where such a pressure shall be found to be sufficient the impression may be made complete by connecting the tube of the ingate with a force-pump, and by such a pump (or any other convenient means) forcing hot air or water into the interior of the piece of material to be manufactured, which may thus be effectually impressed

with the form or pattern which the mold, form, or shape is capable of impressing upon it. In case an article is intended to be made in an open mold, or shape, with a surface having figures in relief, or intaglio thereon, I take the mold, or shape, and place in or upon it a sheet or piece of plastic gutta-percha, or of any of its compounds, of a size or shape as nearly resembling the shape of the intended article as conveniently may be; I then press a piece of gutta-percha, or of its compounds, into, upon, or against the mold, or shape, by a screw-press, or any other convenient means of applying the pressure, so as to force the soft materiial into every part of the mold, or shape, after which the article must be allowed to remain in the mold, or shape, and under pressure, until cold and rigid. If it is intended to use a mold in two parts, as an inside and an outside mold, or shape, for the purpose of producing an article of manufacture, I place the gutta-percha, or gutta-percha compound, in the hollow or interior of the outside mold, or shape, of a size or figure as nearly resembling that of the intended article as conveniently as may be, and I then insert the inside mold, shape, or core within the other mold, and within, upon, or against the material placed therein, and press the molds together by a screw-press, or any other convenient means, so as to force the material into every part of the mold, or shape, after which the article must be suffered to remain in the mold, or shape, and under pressure, until it becomes cool and stiff or rigid. The inside mold, or core, may, when desired, be made in several pieces, and gutta-percha, or any of its compounds, may be introduced between the several pieces of the core so as to make divisions or partings in the interior of the article to be produced.

404 In forming articles of gutta-percha by joining sheets or pieces of gutta percha together I found that pieces of gutta-percha in a cold state cannot be permanently united together in the same way as cold pieces of caoutchouc are usually joined, but if the edges or parts of gutta-percha which are intended to be joined together are softened or made plastic by the application of heat, then they may, by pressure, be effectually and permanently united together. The heat necessary for rendering the edges or parts of gutta-percha soft or plastic may be applied by means of a current of hot air, heated iron, or by any other means which may be found most convenient; care ought, however, to be taken that the parts to be joined are not moistened with water or greased, because such moisture, or any kind of grease, will have the effect of preventing the effectual adhesion of the parts. By adopting this mode of joining the edges of sheets or pieces of gutta-percha together in the manufacture of articles such as are usually made of leather, it becomes unnecessary to sew or stitch such parts together, the parts being more effectually joined by the mode hereinbefore described. Pieces of the compounds of gutta-percha may also be joined together in a similar manner with more or less effect, according to the greater or lesser quantity of gutta-percha of which the compound has been formed. I have also found that sheets or pieces of gutta-percha, or any of its compounds, may be joined together when in a cold state by first covering the parts to be joined together with a solvent or solution of the gutta-percha, or any of its compounds, as a cement, and then bringing the parts together which are to be joined, and keeping them in that state until they are effectually united, which will be generally effected after two or three hours, but much more quickly if bisulphuret of carbon should happen to be the solvent used. This mode of joining pieces of gutta-percha, or any of its compounds, is not so effective as that before described, but may be useful in some cases in which the other mode

405 cannot, with facility, be adopted. Either one or the other mode of uniting pieces of gutta-percha, or any of its compounds, may be adopted for joining together pieces of any article which may have been separately formed in molds, forms, or shapes, so as to complete the manufacture of the intended article. Articles may also be made of gutta-percha, or any of its compounds, and of some other fit and proper material for the production of the intended article. Thus a metallic chain or other weight may be introduced into the interior of any piece or pieces of gutta-percha, or of any of the compounds, which is about to be manufactured in any mold or shape; so, also, if a wooden or other handle is intended to be introduced into any article the gutta-percha, or any of its compounds, of which the other part or parts of the article is or are intended to be used, may be molded upon one end or some other part of the intended handle, by means of a mold, form, or shape, or any other convenient means; and when it is desirable that handles, knobs, screws, hinges, and other furniture and things should be imbedded in any article made of gutta-percha, or any of its compounds, in any mold, form, or shape, such, for example, as doors, framings, panels, or other parts of the bodies of railway or other carriages, and many other articles, such as handles, knobs, screws, hinges, furniture and things, should have the parts thereof, which are to be so imbedded as aforesaid, introduced into the mold, form, or shape in such a manner that the same shall, during the manufacture of such article, be effectually and firmly imbedded in the material of which it is made. When a piece of wood or other material is intended to be introduced into an article to be partly formed of gutta-percha, or any of its compounds, in a shape which would easily draw out of that part of the article which is formed of gutta-percha, or any of its compounds, that part of the material which is intended to be introduced into the gutta-percha, or its compounds, should me made with projections upon it or holes in or through it, so that it may be securely and firmly held by the
406 gutta-percha, or its compounds.

Articles may also be made of gutta percha or any of its compounds, formed upon skeleton or other shapes, forms, or foundations, made of iron, wood, or any other material, such as saddle-trees, skeleton forms, axles or shafts of rollers, &c. The skeleton form or shape of a saddle-tree may be made of perforated iron or other metal, and the plastic gutta percha, or any of its compounds, may be molded upon it into the shape of the intended saddle-tree, care being taken that the plastic material is pressed through the perforations of the skeleton form or shape, so as to unite and bind together the material which is upon each side of the skeleton form or shape. The same mode of manufacturing may be adopted in the production of numerous other articles, and in making some of them a skeleton form or shape of iron or other metal, wire gauze or cloth, or any perforated pieces of metal or other suitable substances, may be used. Thus also skeleton or other forms, shapes, or foundations for hats, bonnets, or linings may be covered with gutta percha, or any of its compounds, in manner aforesaid, and so made into a hat, bonnet, or lining. Skeleton forms, shapes, or foundations may also be covered or saturated with gutta percha, or any of its compounds, by saturating or coating such forms, shapes, or foundations with the gutta percha or compound of gutta percha in a state of solution, and when dry repeating the process, if desired. A roller may be made with a surface of gutta percha, or any of its compounds, by taking a roller of iron, wood, or other material, turned somewhat less in diameter than the intended roller, according to the intended thickness of the gutta percha

or its compounds. Upon this roller of iron, wood, or other material (leaving small orifices or holes in the surface of it, into which parts of the soft material may be pressed to keep the whole firmly in its place), must be placed a sheet of plastic gutta percha, or any of its compounds
(according to the quality which the material of the surface is re-
407 quired to possess), so as to surround and cover the roller equally
in every part, and the edges of the sheet must be pressed together whilst soft, so as to adhere together in manner hereinbefore described; and gutta percha, or any of its compounds, may be put upon the surface of a roller in a mold, form, or shape, so as hereinbefore described.

Thirdly. I employ for ordinary letter-press printing sheets made of gutta percha alone, or together with any other material or materials, and prepared in the manner described in the specification of the letters patent for England, granted to Richard Archibald Brooman, on the eleventh day of March, one thousand eight hundred and forty-five, preferring to have the gutta percha of a light color, or made of a light color by mixing with it whilst passing through the kneading machine (in the manner also explained in the said specification) some flake white, chalk, or other white or light coloring ingredient, reduced to a fine powder. Sheets of gutta percha, or any of its compounds, thus prepared, may be passed through the printing press in the usual way, but without inking the form of types, as usual. By the mere pressure of the dry surface of the type against the dry surface of the sheet of gutta percha or its compounds in the press, distinct and legible impressions of the type will be produced on the sheet. I also employ sheets prepared as last aforesaid in printing by means of engraved or otherwise figured copper or steel plates, or cylinders, and the presses usually made use of for working the same, and by printing upon such sheets without inking the engraved or hollow parts of the plates or cylinders. Plate or cylinders being pressed upon or against sheets by presses in the ordinary way, distinct impressions of the engravings or other figures upon such plates or cylinders will be obtained. I also impress upon such sheets as last aforesaid all such letters, figures, images, and marks as are now
commonly produced on surfaces by means of engraved blocks, or
408 rollers, or dies, or stamps, or punches, or types, whether the same
are engraved or cast in relief or intaglio, or cut through and through; and this also by bringing such blocks, or rollers, or dies, or stamps, or punches, or types into dry contact, as aforesaid, with such sheets and under more or less pressure, employing for the purpose of such pressure any of the well-known means of printing, pressing, striking, stamping, or punching now in common use; and in this case I vary the thickness of the sheet subjected to the operation of the said blocks, rollers, dies, stamps, or punches, or types, according to the degree of high or low relief or intaglio intended to be produced. Sheets of gutta percha punched or cut through and through according to any pattern which may be required may be fastened or cemented upon other sheets, or upon blocks of gutta percha, by means of heat, or by solution, in manner hereinbefore described, so as to form either sunk or raised figures of the required patterns or designs upon the sheets or blocks upon which the perforated sheets may be fastened or cemented; and the different sheets or blocks may be made of various colors, so as to make raised figures or patterns of different colors from the blocks or sheets upon which they are to be fastened or cemented, and to produce various other effects.

In order to produce impressions of a still more distinctive and striking character than are to be obtained by any of the preceding processes,

I prepare the sheet or piece of gutta-percha in such manner that the raised or sunken parts shall be of a different color from the rest, or, as it is technically called, "the ground." In this case I spread the gutta-percha by any of the modes described in the said specification of the said Richard Archibald Brooman hereinbefore referred to, on a surface of cloth, paper, or other suitable material of a color as opposite as may be to that of the gutta-percha; for example, the ground may be black and the gutta-percha white, or vice versa. I then pass a sheet or piece of gutta-percha so prepared and combined, with its gutta-percha
409 surface uppermost, through an ordinary printing press as aforesaid; or I subject it to the pressure of a figured block, or roller, or die, or stamp, or punch, or type also as aforesaid, whereby an impression is produced thereon, in which the figurated or distinctive parts are of the color of the ground, and the rest of the color of the gutta-percha. I also make use of gutta-percha, prepared and combined as last hereinbefore described, and cut into sheets or pieces of any convenient size, as a material for writing and drawing upon without the aid of either ink, or of any other coloring medium. I employ for this purpose a dry style (of ivory, glass, or some other material which will not leave by the mere effect of contact a visible stain) and write or draw therewith by hand on the sheet or piece of gutta-percha surface in the same way as on common paper, with pen and ink, or lead pencil, or crayon.

Fourthly. I prepare a material of gutta-percha, or gutta-percha compound, with a polished, glossy surface, like japanned leather. For this purpose I first give a sheet of gutta-percha, or of gutta-percha compound, a coat of thin solution of gutta-percha, or gutta-percha compound, or a coat of turpentine, for the purpose of making the surface of the sheet more readily receive and retain the varnish which is intended to be put upon it. The sheet thus prepared I varnish over either with Japan varnish or varnish such as is used in making japanned leather, or with varnish such as described in my said specification hereinbefore referred to. A sheet of gutta-percha, or gutta-percha compound, in being thus prepared will generally require only one or two coats of varnish.

Fifthly. I inlay and veneer sheets of gutta-percha, or gutta-percha compound, or make tesselated or figured surfaces thereon, and also unite sheets or pieces of gutta-percha, or any of its compounds, with other substances in the following manner:

410 Upon a flat surface I lay down pieces of gutta-percha or of any of its compounds, colored or not colored, as may be desired, and in the intended forms which are to be pressed into or united to a sheet of gutta-percha or any of its compounds, so as to make a veneered surface of the whole of such sheet, or to inlay a portion or portions of the surface of such sheet. The pieces of gutta-percha or of any of its compounds to be united or pressed into the surface of a sheet may be made thin like veneers and must be placed in the desired positions upon the flat surface upon which they are laid previously to having the sheet pressed upon them. The pieces being thus laid in order upon a flat surface, a sheet of gutta-percha, or of any of its compounds, in a warm and soft or plastic state, is then to be placed on the pieces as they are lying upon the flat surface, against which they must be pressed so as to make the figured pieces, and the remainder of the sheet (if any) not covered therewith, all of an even and flat surface. The surfaces which are intended to come in contact with each other and to unite in this way will be more effectually united by previously giving one of them a thin coat of a similar material in solution, or a coat of turpentine or some other

solvent. Pieces of thin metal, wood and other materials of any desired form may also be united to or pressed upon or into the surface of a sheet or piece of gutta-percha, or of any of its compounds, so as to make a veneered, tesselated or inlaid surface as before described. But such pieces of metal, wood, and other materials should have the surfaces roughened, which are to be brought into contact with the gutta-percha, or gutta-percha compound, and had better be first coated with a solution of gutta-percha or some of its compounds on the surface which is to be placed next the sheet or piece of gutta-percha, or gutta-percha compound. I also cover pieces of wood, metal, papier maché, pasteboard, and other solid substances with veneers or thin sheets of gutta-percha or any of its compounds in a plain or figured state, and either
411 colored or not colored, and when colored either of one or of a variety of colors, the adhesion of the sheets being caused by means of a coat of solution applied in manner aforesaid.

Sixthly. I make paper and pasteboard in the following manner: I take paper pulp or paper dust in a dry state and intimately mix and amalgamate with it a sufficient quantity of gutta-percha to reduce the mass to a plastic or tenacious state; I then pass it between polished rollers or press it between plates into sheets of any required thickness. The paper may be colored by adding any suitable pigment in a state of fine powder during the amalgamation of the materials. I also saturate or coat paper with a solution of gutta-percha by immersing it in a solution of that article or by giving it a coat or coats of such solution, after which it must be dried, and, if desired, pressed or rolled in the ordinary way. Paper may also be prepared by dusting it all over with fine dust of gutta-percha, and then passing it between warm rollers to be pressed. I prefer using paper to be prepared as above described in the unsized state, but sized paper may be used if desired. I also incorporate the gutta-percha with the paper pulp in the moist state as in the ordinary course of manufacture. To effect this purpose I mix the gutta-percha with the pulp in a very finely granulated state by agitation with the paper pulp whilst in the vat (which ought to be kept at about 150° Fahrenheit), or I use a solution of gutta-percha. The paper, when dry, may, if desired, be passed between rollers cold or slightly warm. Pasteboard may be formed by cementing sheets of gutta-percha together or cementing sheets of plain paper to sheets of gutta-percha paper.

Seventhly. I prepare a solution of gutta-percha or a combination of gutta-percha with caoutchouc and jintawan or either of them by dissolving the same in bisulphuret of carbon. This solution must be
412 prepared in the same manner as a solution of caoutchouc, the proportion of the solid material to the solvent being varied according to the purpose for which the solution is required and as the solution may be required to be thicker or thinner. These solutions, especially that of gutta-percha alone, will be found to be valuable for many of the purposes to which solvents are hereinbefore directed to be applied, and they will also be found to be particularly useful for cements and for coatings of various articles of manufacture and for the making of waterproof cloth.

Eighthly. In making several of the articles of manufacture before mentioned or referred to, or intended to be referred to, I sometimes employ a combination of stitching and cementing, as in the case of boxes, cases, portmanteaus, saddlery, trunks, &c., and other articles formed of several parts or pieces, first stitching together the pieces which are to be combined and then doing the joinings over with a solution of gutta-

percha, or covering them with strips of gutta-percha, made to adhere by heat or by a solution of gutta-percha.

Having now described the nature of my said invention and in what manner the same is to be performed, I declare that the following are the several improvements which I claim as constituting the same:

Firstly. The preparing of gutta-percha for manufacturing purposes, as firstly hereinbefore described.

Secondly. The giving of shape and configuration to articles to be made of gutta-percha or any of its compounds, by casting, moulding, pressing, stamping, and otherwise, as secondly hereinbefore described.

413 Thirdly. The impressing of letters, characters, and figures upon sheets, in manner thirdly hereinbefore described.

Fourthly. The varnishing or producing of a smooth surface on sheets of gutta-percha or any of its compounds, as fourthly hereinbefore described.

Fifthly. The veneering and inlaying sheets of gutta-percha, or any of its compounds, and other substances, as fifthly hereinbefore described.

Sixthly. The making of paper and pasteboard with gutta-percha, combined with other materials, and also the covoring of paper with gutta-percha, in solution or powder, as sixthly hereinbefore described.

Seventhly. The employment of bisulphuret of carbon solutions of gutta-percha and its compounds in combination with other substances in articles of manufacture, as seventhly hereinbefore described.

And, eighthly, the combination of stitching and cementing in the production of various articles of manufacture, as lastly hereinbefore described.

In witness whereof I, the said Charles Hancock, have hereunto set my hand and seal, this fourteenth day of November, one thousand eight hundred and forty-six.

CHARLES HANCOCK. [L S.]

And be it remembered, that on the fourteenth day of November, in the year of our Lord 1846, the aforesaid Charles Hancock came before our said Lady the Queen in her chancery and acknowledged the specification aforesaid and all and everything therein contained and specified in form above written. And also the specification aforesaid was stamped according to the *the* tenor of the statute made for that purpose.

Enrolled the fourteenth day of November, in the year of our Lord one thousand eight hundred and forty-six.

(RICHARDS.)

Ex'd.—L. P. H.

414 *Defendants' Exhibit No.* 10.—*J. A. S., Ex'r.*

(65.)

DEPARTMENT OF THE INTERIOR.

(Vignette.)

U. S. PATENT OFFICE.

To all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the bound volumes of the library of this office of the specification and drawing in the

matter of English letters patent granted Henry Valentine Bartlett, dated May 15th, 1846, No. 11209.

In testimony whereof I, W. H. Doolittle, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed, this eighteenth of August, in the year of our Lord one thousand eight hundred and seventy-six, and of the Independence of the United States the one hundred and first.

{ SEAL PATENT OFFICE UNITED STATES OF AMERICA. } W. H. DOOLITTLE, *Acting Commissioner.*

A. D. 1846. No. 11209. Machinery for the manufacture of artificial palates, teeth and gums.

415 BARTLETT'S SPECIFICATION.

To all to whom these presents shall come, I, Henry Valentine Bartlett, of Sheffield, in the county of York, dentist, send greeting:

Whereas her present most Excellent Majesty Queen Victoria, by her royal letters patent, under the great seal of Great Britain, bearing date at Westminster, the fifteenth day of May, in the ninth year of her reign, did, for herself, her heirs and successors, give and grant unto me, the said Henry Valentine Bartlett, my executors, administrators and assigns, her special license, full power, sole privilege and authority, that I, the said Henry Valentine Bartlett, my executors, administrators and assigns, or such others as I, the said Henry Valentine Bartlett, my executors, administrators, or assigns, should at any time agree with and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, vend, within England, Wales, and the town of Berwick upon Tweed and in the islands of Jersey, Guernsey, Alderney, Sark and Man, and also in all her said Majesty's colonies and plantations abroad, my invention of "Improvements in artificial palates, teeth and gums, and certain machinery employed in the manufacture thereof," in which said letters patent is contained a proviso, that I, the said Henry Valentine Bartlett, shall cause a particular description of the nature of my said invention and in what manner the same is to be performed, to be enrolled in her said Majesty's high court of chancery, within six calendar months next and immediately after the date of the said in part recited letters patent, as in and by the same, reference being thereunto had, will more fully and at large appear:

416 Now know ye, that in compliance with the said proviso, I, the said Henry Valentine Bartlett, hereby declare that the nature of my said invention and in what manner the same is performed are fully described in and by the following description thereof (reference being had to the drawings hereunto annexed, that is to say):

In making artificial palates, teeth, and gums, I dispense with all pins, rivets, springs and ligatures, and avoid also entirely the use of metallic substances. I prefer using the ivory of the hippopotamus, commonly known in commerce as African ivory. It is exceedingly durable, not perceptibly affected by the gastric juice or by acids, and preserves its original colour for a long time unimpaired. But where cheapness is an object I employ the ivory of the walrus or sperm whale, or any of the other inferior sorts. I first make a cast of the mouth or part of the mouth which is to be fitted with the artificial substitute in the softened beeswax commonly used in casting. From this cast I take an impression in reverse in plaster of paris, and from that reverse impression or mold I take another in relief in some plastic material which softens and

hardens readily, such as shellac or gutta-percha, which last impression is of course an exact counterpart of the original. I then curve out of a piece of ivory, of the particular sort before mentioned, an exact fac simile of the model so obtained, which shews the parts in which any new teeth required must be inserted, and indicates also the forms to be given to these teeth and to the holes in which they are to be inserted. And I employ for these purposes machinery of the description represented in the drawings hereunto annexed.

Figure 1 of these drawings is an elevation, and figure 2 a ground plan of the said machinery. M is a foundation plate, which supports a frame G_1 G_1, from the top of which rises a forked standard B, which carries a grooved pulley. B_2 G^2 is a drill frame which slides in V grooves
417 within the larger frame G^1. E is the drill spindle, which is connected at top by means of a cord C^1 carried over the pulley B^2 to a ratchet lever L, which again is connected by a cord C^2 to a treadle machine N. The spindle E is screwed nearly throughout its entire length, as shown, but has a free up-and-down motion through plain holes in the cross-pieces *a* and *b* of the two frames G^1 and G^2, the object of so screwing it being to enable it to be stopped at any given degree of elevation by means of the lock screw F. At bottom, the spindle rests in a socket in the top of the stock H^1, in which is inserted the drill H^2. At top it has a broad slot in it, within which there is fixed a grooved pulley D on which the end A^2 of the weighted lever A_1 presses so as to keep the drill to its work, and at such a degree of pressure as may be required. P is a pulley which is fixed on the top end of the drill stock within the frame G^2, and is caused to revolve in a horizontal direction by means of the back spindle and pulleys O, so as to give a horizontal circular motion to the drill. R is a circular rest or chuck on which the piece of ivory to be operated upon is placed, and held fast in manner separately represented in plans figures 3 and 4, figure 3 showing how a complete pallet is secured to the face of the rest, in order to have holes made for the insertion of the teeth, and figure 4, how a single tooth is secured. J. J. J. J. are four centre screws for keeping the rest R in its place.

Figure 5 to 18, both inclusive, are full-sized representations of the different sorts of drills and bits, which I employ according to the different forms to be given to the palates, or to the gums or to the teeth, or to the holes for the reception of the teeth, as exemplified in the group of figure 19. T is the nozzle-end of a flexible pipe through which a stream of air is blown upon the work while it is under the operation of the drill in order to clear away the chips and dust as produced, and to keep the ivory at a low temperature.

418 Figure 20 shows a complete set of artificial teeth both under and upper, fixed in their gums or sockets, which latter being of the exact form of the mouth, are retained therein by the mere force of atmospheric pressure. I prefer making the teeth of any approved mineral composition, but they may be made of ivory, or natural teeth may be adapted to the artificial palates and gums aforesaid.

And having now described my said invention, and in what manner the same is to be performed, I declare that what I claim is the manufacture of palates, teeth and gums made of hippopotamus or other ivory, and the fitting in of teeth into artificial palates and gums without pins, rivets, springs or ligatures, in manner and by means of the machinery before described.

In witness whereof I, the said Henry Valentine Bartlett, have hereunto set my hand and seal, this thirteenth day of November, in the year of our Lord one thousand eight huned and forty-six.

H. V. BARTLETT. [L. S.]

And be it remembered that on the thirteenth day of November, in the year of our Lord 1846, the aforesaid Henry Valentine Bartlett came before our said Lady the Queen in Her Chancery, and acknowledged the specification aforesaid, and all and everything therein contained and specified, in form above written.

And also the specification aforesaid was stamped according to the tenor of the statute made for that purpose.

Enrolled the fourteenth day of November, in the year of our Lord one thousand eight hundred and forty six.

(WILSON.)

Ex'd.—H. H.

419 *Defendant's Exhibit No. 11.—J. A. S., Ex'r.*

(65.)

DEPARTMENT OF THE INTERIOR.

(Vignette.)

U. S. PATENT OFFICE.

To all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the bound volumes of the library of this office of the specification in the matter of English Letters Patent granted Moses Poole, dated October 1st, 1852, No. 24.

In testimony whereof I, R. H. Duell, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this seventeenth day of August, in the year of our Lord one thousand eight hundred and seventy-six, and of the Independence of the United States the one hundred and first.

{ SEAL PATENT OFFICE UNITED STATES OF AMERICA. } *Commissioner.*

Specification in pursuance of the conditions of the letters patent filed by the said Moses Poole, in the Great Seal Patent Office, on the 30th March, 1853.

To all to whom these presents shall come: I, Moses Poole, of Serle street, in the county of Middlesex, gentleman, send greeting:

420 Whereas Her Most Excellent Majesty, Queen Victoria, by her letters patent, bearing date the first day of October, in the year of our Lord one thousand eight hundred and fifty-two, in the sixteenth year of her reign, did for herself, her heirs and successors, give and grant unto me, the said Moses Poole, her especial license that I, the said Moses Poole, my executors, administrators and assigns, or such others as I, the said Moses Poole, my executors, administrators and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and the Isle of Man, an invention for "Improvements in making covers for and in binding books and portfolios, and in making frames for pictures and glasses" upon the condition (amongst others) that I, the said Moses

Poole, by an instrument in writing under my hand and seal, should particularly describe and ascertain the nature of the said invention and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said letters patent.

Now know ye that I, the said Moses Poole, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof (that is to say):

This invention is communicated to me from America on behalf of Mr. Goodyear, the inventor, and consists of employing in such manufactures of a hard substance produced by subjecting india rubber combined with sulphur, with or without other matters, to a high temperature, and the invention also consists of employing india rubber combined with
421 sulphur in binding or fixing the leaves, and then subjecting the india rubber to a heat to produce a change therein. And in order that the invention may be most fully understood and readily carried into effect, I will proceed to describe the means pursued by the inventor, and as communicated to me.

In making the backs or covers for books and portfolios I employ sheets of india rubber combined with sulphur, or matters containing sulphur; for this purpose two-thirds by weight of india rubber to one-third by weight of sulphur are ultimately blended together by means of a masticating machine, with or without coloring matters, and the same being rolled into thin sheets are placed on to a thick paper board or strong woven fabric, the india rubber being turned over at the edges, according to the size and character of the book or portfolio, or the covers and back are made wholly of sheets of the compounded materials by using thicker sheets of the compound with fibre or woven fabric adhering to the inner surfaces, and, having shaped them, they may be pressed into a mould to obtain the desired device or character, and the process of heat may be conducted whilst the compound is between the surfaces of the molds, or the process of heat may be performed before obtaining the desired pattern, and then producing the device by pressure between dies or engraved surfaces, the hinges are produced by vulcanized india rubber alone applied to the surfaces of a woven fabric. The heat necessary for obtaining the desired result requires to be applied for about six hours, raising the temperature slowly up to about 230° of Fahrenheit, say in about half an hour, and retaining about that temperature for one and a half hour, and then raising it again gradually during the remainder of the six hours up to about 295° of Fahrenheit; but where a large quantity of foreign matters are in the compound the heat may be raised more quickly. In cases where the covers are to be affixed by cementing to other matters, after the process of
422 heat, such as paper, pasteboard or cloth, the surfaces of the covers should be coated with woven fabric before subjecting the covers to heat, by which means the covers can have affixed thereto paper or other material which can thereby be made to adhere.

In those cases where the ornamenting of the exterior surfaces of covers of the material above described may be done after applying the heat, then the surfaces are to be acted on when at a temperature of about 300° of Fahrenheit, when the matter or substance will take very sharp impressions.

In carrying out the second part of the invention the leaves of the book are at the back to be coated with India rubber cement containing sulphur for producing vulcanization, which I prefer to contain at the

rate of one pound of India-rubber, about two ounces of sulphur, half a pound to a pound of white lead, and half an ounce of the carbonate of potash; straps of woven fabric may be applied across at intervals, extending across the hinge for the purpose of strengthening the back and hinge of the book; and in order that the edges of the leaves may be well combined with the India-rubber cement, I have found it desirable to rough the edges with a rasp or sand-paper, or other instrument; and having thus coated the back of the book, I apply heat till the change called vulcanization is produced, which will generally result in about fifteen minutes, by applying heat of about 265° Fahrenheit by a metal or other surface; and this I find it convenient to do by means of a hollow metal, shape to the form of the back of the book, in which water is caused to circulate in the manner known as Mr. Perkin's plan, in closed pipes.

In making the frames for pictures and glasses I employ sheets of the compounds above described, and either use them as veneers after
423 the sheets are vulcanized to cover the surfaces of wood frames, or else I mold them solid to the design or device desired, as when molding other articles of such compounds, and as is fully described in the specification of another patent granted to me in behalf of the said Mr. Goodyear, and when very sharp and well finished devices are desired, the hardened material may be pressed, at a temperature of about 300° Fahrenheit, between dies.

Having thus described the nature of the said invention, and the manner of performing the same, I would have it understood that what I claim is the application of the hard substance of a whalebone or ivory-like texture, produced by combining India-rubber and sulphur, and subjecting the same to heat, to the making of the covers of books and portfolios, and to the making of frames for pictures and glasses.

And I also claim the connecting of the leaves of books together with India-rubber combined with sulphur, and converting or vulcanizing the same by heat.

In witness whereof I, the said Moses Poole, have hereunto set my hand and seal this twenty-eighth day of March, in the year of our Lord one thousand eight hundred and fifty-three.

MOSES POOLE. [L. S.]

Witness:
B. GOBEY.
Ex'd.—E. A. M.

424 *Defendants' Exhibit No.* 12.—*J. A. S., Ex'r.*

(65.)

THE U. S. PATENT OFFICE.

(Vignette.)

To all persons to whom these presents shall come, greeting:

This is to certify, that the annexed is a true copy from the bound volumes of the library of this office of the specification in the matter of English letters patent granted Moses Poole, dated October 1st, 1852, No. 43.

In testimony whereof I, R. H. Duell, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this seventeenth day of August, in the year of our Lord one thousand eight hun-

dred and seventy-six, and of the Independence of the United States the one hundredth.

{ SEAL PATENT OFFICE } R. H. DUELL,
{ UNITED STATES OF AMERICA. } *Commissioner.*

Specification in pursuance of the condition of the letters patent filed by the said Moses Poole in the Great Seal Patent Office, on the 30th March, 1853.

To all to whom these presents shall come, I, Moses Poole, of Serle
425 street, in the county of Middlesex, gentleman, send greeting:

Whereas, Her Most Excellent Majesty, Queen Victoria, by her letters patent, bearing date the first day of October, in the year of our Lord one thousand eight hundred and fifty-two, in the sixteenth year of her reign, did for herself, her heirs and successors, give and grant unto me, the said Moses Poole, her special license that I, the said Moses Poole, my executors, administrators and assigns, or such others as I, the said Moses Poole, my executors, administrators and assigns, should at any time agree with, and no others, from to time, and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise and vend within the United Kingdom of Great Britain and Ireland, the Channel Islands and Isle of Man, an invention for "improvements in harness and in horse and carriage furniture," upon the condition (amongst others) that I, the said Moses Poole, by an instrument in writing under my hand and seal, should particularly describe and ascertain the nature of the said invention and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said letters patent.

Now, know ye, that I, the said Moses Poole, do hereby declare the nature of the said invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof (that is to say):

This invention is a communication from America in behalf of Mr. Goodyear, the inventor, and consists of applying in such manufacture a hard substance produced from India-rubber and sulphur, with or without other matters, by subjecting the same to heat. And in order that
426 the invention may be most fully understood and readily carried into practice, I will proceed to describe the means pursued by the inventor, and I would first remark that in the specification of a previous patent granted to Mr. Alfred Vincent Newton in behalf of the said Mr. Goodyear, the hard material herein mentioned was described to be used in combination with articles of metal in making parts of harness and parts of carriages, such as saddle-trees, terrets, bits, stirrups, martingale rings, and dasher irons. Now, this invention consists of employing this hard material in making various articles where no metal is used, or where metal is only used as an accessory or furniture to the article so made, the present invention being intended, as much as may be, to dispense with the use of metal and leather when making those parts, which have heretofore been of metal or of metal and leather combined, and to substitute the substance above mentioned.

For this purpose I make saddle-trees, and the exterior parts which have heretofore been made of leather, of the substance or compounded materials above mentioned, molded or otherwise formed according to the nature of the article, and where necessary to be lined, the same is done by sewing through and through the parts as if they were of leather, or

else in shaping and forming the articles when made of sheets of the compounded material alone, I apply strong fabric and cause it to adhere to one surface before subjecting the parts of a saddle or harness or horse or carriage furniture to heat, in order that the fabric may become the means of affixing the padding or lining thereto; but for the parts which are substituted for those made of thick leather, I prefer to use a fabric made by uniting a number of thin fabrics together made with coats of the compounded material between them. And I would state generally as to the parts of harness and carriage furniture that the substance or compounded material may be made very tough and leather-like by
427 not carrying the heat beyond 290° to 293° Fahrenheit, but where the compounded materials are intended to be substituted for iron or metal, then the heat is to be raised from 295° to 305° of Fahrenheit, but if largely composed of foreign matters the heat may be raised more quickly; and in making rings, bridle-winkers or harness ornaments in substitution of like articles of horse and carriage furniture heretofore made of metal, I mold the article and then subject the same to heat, or else I roughly make up the article to nearly the desired form, and after having connected the same by heat I cause them to be pressed in dies when at a temperature of about 300° of Fahrenheit, by which a very excellent finish is obtained to the article.

In applying heat to such article, it is desirable that the temperature should be raised gradually, say in half an hour, to 230° of Fahrenheit, and retained at that degree for about an hour and a half, and then raised gradually (unless there is much foreign matter in the compound, when the heat may be raised more quickly) to 295° to 305° of Fahrenheit, gradually during the remainder of six hours, except when a more leather-like product is desired, then the temperature should not exceed, or materially exceed, about 293° of Fahrenheit. For making the strongest and hardest articles, it is preferred to use india-rubber and sulphur alone, but for the parts which have heretofore been made of leather, it is preferred to use bituminous matters with such compound as is described in the specification of another patent granted to me in behalf of the said Mr. Goodyear; and in some cases a frame or parts of the articles may be made by preparing the frame of the hardest substance, or of iron covered with sheets of this material, and uniting the other parts thereto before applying the heat as aforesaid.

And in all cases, the relation between the india-rubber and sul-
428 phur in the compound is to be at the rate of about two parts of india-rubber and one part of sulphur by weight, such materials being well masticated or kneaded together.

Having thus described the nature of the invention, and the manner of performing the same, I would have it understood, that what I claim is the application, in the manner herein described, of india-rubber combined with sulphur, with or without other matters, in the manufacture of harness, and horse and carriage furniture.

In witness whereof, I, the said Moses Poole, have hereunto set my hand and seal, this twenty-eighth day of March, in the year of our Lord one thousand eight hundred and fifty-three.

MOSES POOLE. [L. S.]

Witness: B. GOBEY.

Exd.—E. A. M.
Rec. 326—19

Defendant's Exhibit No. 13.—*J. A. S., Exr.*

(65.)

DEPARTMENT OF THE INTERIOR.

(Vignette.)

U. S. PATENT OFFICE.

To all persons to whom these presents shall come, greeting:

429 This is to certify that the annexed is a true copy from the files of this office of the file wrapper and contents in the matter of letters patent granted John A. Cummings, dated June 7th, 1864, No. 43,009, for impt. in artificial gums and palates.

In testimony whereof, I, R. H. Duell, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this seventeenth day of August, in the year of our Lord one thousand eight hundred and seventy-six, and of the Independence of the United States the one hundred and first.

SEAL PATENT OFFICE, UNITED STATES OF AMERICA.

R. H. DUELL,
Commissioner.

$15 cash; 2 drgs.; model M.

The petition of John A. Cummings, of Boston, in the county of Suffolk and State of Massachusetts, respectfully represents that your petitioner has invented certain new and useful improvements in palates, &c., an exclusive property in which he is desirous of having secured to him and his legal representatives, by letters patent, according to law, having paid fifteen dollars into the Treasury of the United States, and complied with all the regulations of the patent act, in such cases made and provided.

Boston, March 1st, 1864.

JOHN A. CUMMINGS.

430 SIR: I hereby recognize and appoint Joseph Gavett, of Boston, or his accredited agent or agents, as my agent and attorney, to solicit and receive letters patent for my artificial palate, also for withdrawing my application for the same, should it be found necessary, and in general to do all such things in the premises as he may deem to be for my advantage.

Boston, March 1st, 1864.

JOHN A. CUMMINGS.

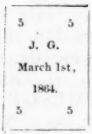
1 Dollar 1
J. G.
March 1st,
1864.
1 Dollar 1

STATE OF MASSACHUSETTS,
County of Suffolk, ss:

On this first day of March, in the year 1864, personally appeared b-

fore me the above-named John A. Cummings and made oath that he verily believes himself to be the original and first inventor of the improvement herein specified; that he does not know or believe the same to have ever before been known or used prior to his invention of the same, and that he is a citizen of the United States of America.

JOSEPH GAVETT,
Justice of the Peace.



431 To all persons to whom these presents shall come:

Be it known that I, John A. Cummings, of Boston, in the county of Suffolk, and State of Massachusetts, have invented certain new and useful improvements in the manner of forming artificial palates and gums used for inserting artificial teeth, and that the following description taken in connection with the accompanying drawings, hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said invention, by which it may be distinguished from others of a similar class, together with such parts as I claim and desire to have secured to me by letters patent.

The figures of the accompanying plates of drawings represent my improvements; fig. 1 is a front elevation of a set of artificial teeth and plate formed by my improved method, fig. 2 is a view of the lower side of the plate and teeth, fig. 3 is a central vertical section of the same.

The method hitherto practiced of attaching artificial teeth to a metallic plate, fitting to the roof of the mouth, is attended with many objections and inconveniences, as the plate being hard and unyielding, naturally hurts the mouth and in some degree impedes mastication and perfect articulation, while the expense of the metal employed prevents many from availing themselves of the advantages of artificial teeth.

The present invention consists in forming the plate and gums to which the teeth are attached of rubber or some other elastic material, so indurated as to be rigid enough for the purposes of mastication and pliable enough to yield a little to the motions of the mouth and in one piece, the teeth being imbedded in the elastic material while the
432 said material is in a soft condition and then baked with the gums and plate, so that the teeth, gums, and plate will all be connected, forming, as it were, one piece.

a a a, &c., in the drawings, represent the artificial teeth prepared in the usual manner. The plate and gums b b are formed in one piece and of rubber or of rubber and the compounds commonly employed therewith, or of gutta percha, or in fact of any elastic substance, which can be reduced to a soft condition and then vulcanized or hardened sufficiently to answer the purpose. The rubber or other material used is first molded to fit the shape of the mouth and the gums formed, and while soft and pliable the teeth a a are embedded in the gums, and, as an additional security, fastened to the same by small pins, c c, fig. 3. The teeth, gums, and plate being thus connected, are then baked until the elastic material becomes sufficiently vulcanized, when the process is completed, the plate being hard and rigid enough for the purposes of

mastication and yet by its elastic nature yielding to the motions of the mouth, while the teeth are firmly embedded and secured in the gums.

The plate and gums can be colored in any proper manner to imitate nature.

Having thus described my improvements, I shall state my claim as follows:

What I claim as my invention and desire to have secured to me by letters patent, is forming the plate and gums in which the teeth are inserted, in one piece of hard rubber or vulcanite, i. e., an elastic material which can be hardened sufficiently for the purpose of mastication and retain a portion of its elasticity, so as to yield a little to the motion of the mouth, as herein set forth and for the purposes specified.

JOHN A. CUMMINGS.

433 Witnesses:
A. POLLOK.
J. L. COOMBS.

(Endorsed:) Rec'd & filed M'ch 25, '64. J. D. P.

7. U. S. PATENT OFFICE,
April 7th, 1864.

SIR: In the examination of your application for letters patent for a mode of securing artificial teeth to gum plates, it is found that the substance of your present claim is embraced in an application filed by you in 1855 and rejected for want of novelty.

It appears that a satisfactory reference was then given to the use of gutta percha and a disclaimer to it made by you, while your present claim and specification is broad enough to cover it. Your claim was then confined to what was known as "hard rubber," now called "vulcanite," and although three times rejected, it does not appear that this material was ever before used for this purpose, the case of Stearn's vulcanized rubber palate and velum, to which you were then referred, having no bearing whatever upon your invention.

In justice therefore to your rights as an inventor, the office will not object to the admission of a claim limited to the use of this ma-
434 terial for this purpose. The specification and drawings are herewith returned for amendments in particulars noted as defective, and a modification of the claim.

JOHN A. CUMMINGS,
Care A. POLLOK, Esq., Present.

234.

(Endorsed:) Office to J. A. Cummings, Apl. 7, '64, C. G. P., (18).

WASHINGTON, *April* 12, 1864.

I hereby amend my specification of improvements in artificial palates and gums by inserting in the fourth line of the claim between the words "of" and "rubber" the word "hard."

And I also amend my said specification by erasing in the fourth line of the claim the word "other," and by substituting therefor the following, "vulcanite, i. e., an."

I also amend said specification by erasing in the fifth line of the claim the words "or material."

JOHN A. CUMMINGS,
By A. POLLOK, *His Att'y.*

Exd.—S. F. S.

(Endorsed:) Amendment April 12, 1864. Copy.

Memorandum of fee paid U. S. Patent Office.

435 Inventor, J. A. Cummings.
Invention, artificial palates.
Date of payment, May 23, 1864.
Fee, $20. Cert.
Solicitor, A. Pollok.
Boston, March 5, 1865.
Exd.—S. F. S.

In the matter of the application of John A. Cummings for patent for improv'ts in artificial palates, please allow A. Pollok, of Washington, D. C., to act in my stead.

JOSEPH GAVETT.

To the Hon. Commissioner of Patents.

1864.

No. 43009, page 53-47.

John A. Cummings, of Boston, county of Suffolk, State of Mass.
436 Artificial gums and palates.
Rec'd, March 25, 1864.
Petition, " " "
Affidavit, " " "
Specification, " " "
2 drawings, " " "
Model, " " "
Cert. dep.
1 cash, $15, M'ch 25, 1864.
1 add'l fee cert., $20, May 23, '64.
" " cash.
Examined, Chas. G. Page, April 21, 1864.
2 issue, Hayes, April 28, 1864.
4 patented June 7, 1864, and
Recorded vol. 162, page 383.
Circular, April 30, '64, on
Jos. Gavett, Boston, or
A. Pollok, Pres't.
1864.
Exd.—J. A. W.
R't'd spec. dr'g, April 7th, 1864.

(Endorsed:) Imp't in artificial gums and palates.

437 *Defendant's Exhibit No. 2.*

United States circuit court, district of Massachusetts. In equity.

THE GOODYEAR DENTAL VULCANITE COMPANY and Josiah Bacon
vs.
DANIEL H. SMITH.

Proofs on the part of the defendant for final hearing, taken before John A. Shields, one of the standing examiners of the court, under and pursuant to the 67th rule in equity as amended, and pursuant to stipulation between counsel in this case.

NEW YORK, *November 4th*, 1873.

Met pursuant to notice given on the part of the defendant, service of which is admitted by counsel for complainants.

Present: Henry Baldwin, jr., esq., counsel for defendant, and B. F. Lee, esq., counsel for complainants.

Counsel for defendant offers and puts in evidence certified copies as specified hereunder, and marked by the examiner respectively:

Defendant's Exhibit No. 1, being certified copy of the letters patent No. 8075, for improvement in the manufacture of India-rubber, issued to Nelson Goodyear, dated May 6th, 1851.

Defendant's Exhibit No. 2, being certified copy of the reissued letters patent No. 556, dated May 18th, 1858, granted to Henry B. Goodyear, administrator of Nelson Goodyear.

Defendant's Exhibit No. 3, being certified copy of the reissued letters patent No. 557, dated May 18th, 1858, granted to Henry B. Goodyear, administrator of Nelson Goodyear.

Defendant's Exhibit No. 4, being certified copy of the file-wrapper and contents in the matter of the letters patent granted Charles
438 Goodyear, dated April 12th, 1853, No. 9668, for improvement in manufacturing gutta-percha and India-rubber.

(Objected to as irrelevant, incompetent, and as not noticed in the answer.)

Defendant's Exhibit No. 5, being certified copy of the letters patent dated April 12th, 1853, granted to Charles Goodyear for improvement in manufacturing gutta-percha and India-rubber.

Defendant's Exhibit No. 6, being certified copy from the English Patent Office of the record in the matter of the English letters patent No. 577, granted to Charles Goodyear, jr., dated 14th March, 1855, for improvements in the plates of artificial teeth.

Defendant's Exhibit No. 7, being a certified copy from the English Patent Office of the English letters patent No. 577, granted to Charles Goodyear, jr., for improvements in the plates of artificial teeth, and dated 14th March, 1855.

Defendant's Exhibit No. 8, being certified copy from the English Patent Office of the specification of Charles Goodyear, jr., of improvements in the plates of artificial teeth, for which English letters patent No. 577 were granted to him, dated 14th March, 1855.

Defendant's Exhibit No. 9, being certified copy of American letters patent granted Sharpless Clayton, dated January 2d, 1855, No. 12156, for improvement in teeth.

Defendant's Exhibit No. 10, being an agreed copy of the file-wrapper in the matter of the application of Sharpless Clayton for the letters-patent Exhibit No. 9. Complainants' counsel, waiving any objection to the absence of a Patent Office certificate, but the same being objected to as incompetent and irrelevant and as not noticed in the answer.

Defendant's Exhibit No. 11, being certified copy of the letters patent granted Alfred A. Blandy, dated March 3d, 1857, No. 16708, for improvement in casting plates for artificial teeth.

Defendant's Exhibit No. 12, being a certified copy of English specification pertaining to English letters patent No. 12241, dated August 15th, 1848, granted to Edwin Thomas Truman for an improved method or methods of constructing and fixing artificial teeth and gums, and supplying deficiencies in the mouth.

(Objected to as not named in the answer.)

Defendant's Exhibit No. 13, being certified copy of the English specification pertaining to the English letters patent No. 893, dated April 21st, 1855, granted to Henry Schoofs for improvement
439 for making, fixing, or attaching articles to the teeth, gums, and palates.

Defendant's Exhibit No. 14, being certified copy of the specification pertaining to English letters patent No. 193, dated January 21st, 1859, granted to James Childs for an improvement in applying heat in the manufacture of artificial gums and teeth and other articles composed of India-rubber or gutta-percha combined with sulphur.

Defendant's Exhibit No. 15, being a certified copy of the specification pertaining to the English letters patent No. 1421, dated June 11th, 1859, granted to George Claudius Ash for improvements in the manufacture of artificial teeth.

Defendant's Exhibit No. 16, being a certified copy of the specification pertaining to English letters patent No. 1842, dated August 9th, 1859, for improvements in coloring and hardening elastic gums for dental purposes, granted to F. L. Lawrence.

Defendant's Exhibit No. 17, being certified copy of the specification pertaining to English letters patent No. 2295, dated October 8th, 1859, granted to James Childs for improvements in the manufacture of artificial gums.

Defendant's Exhibit No. 18, being certified copy of the specification pertaining to English letters patent No. 2790, dated December 8th, 1859, granted to John Macintosh for improvements in setting artificial teeth.

Defendant's Exhibit No. 19, being certified copy of the specification pertaining to English letters patent No. 4, dated January 2d, 1860, granted to Henry Andrew Dewar for improvements in moulding or applying India-rubber as the basis of artificial teeth, and in apparatus for the same.

Defendant's Exhibit No. 20, being certified copy of the specification pertaining to English letters patent No. 1549, dated June 26th, 1860, granted to Matthew Cartwright for improvements in the manufacture of mouth-pieces for dental and other purposes.

Defendant's Exhibit No. 21, being a certified copy of the drawing in matter of the application of Robert Haering, filed March 25th, 1856, for artificial teeth.

Defendant's Exhibit No. 22, being a certified copy of the file-wrapper and contents in the matter of the application of Robert Haering, filed March 25th, 1856, for artificial teeth.

Defendant's Exhibit No. 23, being a certified copy of the file-wrap-
440 per and contents in matter of the letters patent granted to John B. Newbrough, assignee of Robert Haering, dated January 19, 1869, No. 85927, for improved mode of mounting artificial teeth.

(Objected to as irrelevant, incompetent, and as not noticed in the answer.)

Defendant's Exhibit No. 24, being a certified copy of the file-wrapper and contents in the matter of the reissued letters patent granted to the Dental Vulcanite Company, dated January 10th, 1865, No. 1848, in improvement in artificial gums and palates.

Defendant's Exhibit No. 25, being a certified copy of the file-wrapper and contents in the matter of the reissued letters patent granted to the Dental Vulcanite Company, dated March 21st, 1865, No. 1904, for improvement in artificial gums and palate.

Also certified copies from the records of the Patent Office of the following assignments under letters patent No. 8075, granted to Nelson Goodyear, dated May 6th, 1851 (and under the reissues, No. 556 and 557, of said patent), to wit:

Certified copy of the assignment by H. B. Goodyear, administrator of Nelson Goodyear, deceased, to the Beacon Dam Company, dated October 22d, 1856, marked "Defendant's Exhibit No. 26."

Defendant's Exhibit No. 27, being a certified copy of the assignment by Charles Goodyear and H. B. Goodyear, administrator of Nelson Goodyear, deceased, to Clark S. Putnam, dated July 15th, 1856.

Defendant's Exhibit No. 28, being a certified copy of the assignment of C. S. Putnam to B. W. Franklin, dated May 28th, 1860.

Defendant's Exhibit No. 29, being a certified copy of the assignment by Bradley W. Franklin to the American Hard Rubber Company, dated June 15th, 1860.

Defendant's Exhibit No. 30, being a certified copy of the assignment by H. B. Goodyear, administrator of Nelson Goodyear, deceased, to the Goodyear Dental Rubber Company, dated May 1st, 1866.

Defendant's Exhibit No. 31, being a certified copy of the assignment by the Goodyear Dental Rubber Company to Samuel A. Duncan, dated July 17th, 1866.

Defendant's Exhibit No. 32, being a certified copy of the assignment by Henry B. Goodyear, administrator of Nelson Goodyear, deceased, to the American Hard Rubber Company of Queen's County, dated April 28th, 1866.

441 Defendant's Exhibit No. 33, being a certified copy of the assignment by the American Hard Rubber Company of Queen's County, to Samuel A. Duncan, dated July 24th, 1866.

Defendant's Exhibit No. 34, being a certified copy of the assignment by Henry B. Goodyear, administrator of Nelson Goodyear, deceased, to Samuel A. Duncan, dated July 24th, 1866.

Defendant's Exhibit No. 35, being a certified copy of the assignment by Samuel A. Duncan to the Goodyear Dental Vulcanite Company, dated January 7th, 1868.

GEORGE E. HAWES, a witness called on behalf of the defendant, having been duly sworn, deposes and says as follows:

Q. 1. What is your name, age, and occupation?

A. George E. Hawes, 63 years of age; residence, Bond street, New York City; am a dentist.

Q. 2. How long have you resided in New York City?

A. Forty years last May.

Q. 3. During how much of that time have you practiced dentistry in New York City?

A. All of the time, with the exception of the usual and necessary vacations.

Q. 4. In the course of this practice have you used any, and if yea, what substances or materials as bases or plates for artificial teeth, or teeth and gums?

A. Silver, gold, hippopotamus teeth, tin, type metal, vulcanite, platina. To supply the deficiencies of gum, the hippopotamus, also, and tin; silicious material on the platina.

Q. 5. When did you first use tin for such purpose, and during what period?

A. I began to use tin in 1838, gradually perfecting it and the process during 1839–40 and 1850.

Q. 6. Please describe the tin base or plate as made, and the process of making it, as perfected by you in 1850.

A. The process was the taking of the impression of the jaw in wax and filling it with plaster of Paris; fitting a thin plate over the jaw where teeth and gum were to be supplied, arranging beeswax upon
442 that plate and the teeth in proper condition for the mouth; taking the whole mass, placing it upon the aforesaid impression of plas-

ter, pouring on plaster in a creamy condition over the teeth, gum, and tin plate, and the former impression. I ought to have added that the former impression should be oiled, so that the two parts could be separated. After the whole mass was sufficiently dry, separate them, remove the wax; remove it either by a knife or place it before the fire and let it be absorbed into the plaster. Prepare two sprew-holes for the waste materials, confine those two parts together by an iron wire or a tin flask; place the mass in the fire, with one sprew-hole to pour in the tin, the other on a level with the former, in order to let out the air and to indicate when the mould is full; remove from the fire, and when cool finish in the ordinary way to suit the mouth. I should have said the teeth remaining imbedded in the upper part of plaster mould after the wax had been removed and the tin being poured in embraced the necks of the teeth, and being secured also by the platina pins embodied in the teeth.

Q. 7. At what stage of the process did you pour in the tin?

A. I pour the tin into the mould when it is of that degree of heat of fusing tin; that is indicated by leaving a small piece of tin upon the mould, and when that fuses it is time to pour.

Q. 8. How were the contents of the mould, after cooling, removed from the mould?

A. Destroyed.

Q. 9. What was destroyed?

A. The mould was destroyed.

Q. 10. Can you produce a model of the mould, and of the teeth and wax placed therein, as above described?

A. Yes. (Witness produces model, which is put in evidence, and marked Exhibit George E. Hawes, No. 1.) The piece marked A, I have made removable, to show the teeth, but it should be solid.

Q. 11. Can you produce, and if yea, please do so, a plate or piece such as made by you in 1850 by the above-described method?

A. Yes, sir. (Witness produces piece which is marked George E. Hawes, No. 2.)

Q. 12. When was Exhibit George E. Hawes, No. 2, made? and state if it has been worn, and, if you know, how long.

A. I am not sure when it was made, but quite confident it was made in 1850, and worn about ten years.

443 (The words "but quite confident it was made in 1850" objected to as incompetent.

Q. 13. State, if you know, what the piece now shown you represents.

A. It represents a set of teeth made from the Exhibit George E. Hawes, No. 1, made on that model by myself.

(The said piece is put in evidence, and marked George E. Hawes, No. 3.

WITNESS says: I would like to add there that it is in an unfinished and rough state.

Q. 14. Please state how many pieces such as illustrated by Exhibit George E. Hawes, No. 2, you made in 1850 by the method above described.

(Objected to as leading and as assuming what is not in evidence.)

A. One, certainly, and I am not sure how many.

Q. 15. Give your reasons for being confident that Exhibit George E. Hawes, No. 2, was made in 1850.

(Objected to as incompetent and irrelevant and leading.)

A. The reason why I know I made this in 1850—it being a new thing, and desiring to have patients that were in need of such dentures that

would be would be willing to try a new thing—I desired a lady from Staten Island to submit to the operation.

Q. 16. Are you sure that you made more than one such plate in 1850?

(Objected to on the same grounds and as already answered.)

A. Yes.

And in answer to cross-examination, the witness says as follows:

X Q. 17. How did you use tin in 1838, '39, and '40, for the purpose of making dental plates?

A. In various ways.

X Q. 18. Describe the various ways.

A. Sometimes pure tin was used, sometimes fused on silver plate; sometimes gold was used.

X Q. 19. Do you mean that gold and tin were used together?

A. Mechanically together; yes.

X Q. 20. Explain to the court how tin and gold were used together to make a dental plate at that time.

A. The impression of the mouth was taken in the ordinary
444 manner; the impression was filled with plaster Paris. The dies from that cast made of zinc, counterpart lead, gold plates swedged between, gold plate put on to the aforesaid plaster cast, wax placed upon it and teeth upon the wax, arranged to conform to the necessity of the operation, the whole mass removed from the mouth, placed upon the aforesaid plaster cast—the plaster being oiled upon the whole surface where the plate rests, additional plaster poured on in a creamy condition; when dry the two parts separated, the wax removed, the gold plate washed or painted with muriate of zinc; the two parts parts then put together, with two sprew-holes at a convenient point to pour the tin to fill the vacuum that the wax had left, thus embracing the necks of the teeth, together with the platinas in the teeth, when the tin is poured into the cast. The mass being during this time in the fire heated to the degree of heat of fusing tin, which is known by a small piece of tin placed outside on top of this mould to indicate when it is fused. The sprew-holes must be upon a level one of the holes for the purpose of pouring in the tin, and for the purpose of the escape of the air in the other as the tin goes in. When the mould is sufficiently cool, remove and destroy it; finish up the set in the ordinary way. The whole mass may be gilded with gold at pleasure.

X Q. 21. When this plate came out it was composed of a gold base, a tin mass adhering to the gold base with the teeth imbedded in the tin mass; was not that it?

A. Yes, sir.

X Q. 21. What do you mean by finishing it? What did you do next?

A. The first process after taking the set of teeth from the mould is to file and finish in the usual way, and polish, that no irritation may be produced in the mouth.

X Q. 22. When removed from the mould, did the tin adhere closely to the teeth, or was there a slight opening between the teeth and the tin which had to be closed up by burnishing or otherwise?

A. The tin adhered to the teeth and hugged mechanically well—no joint could be better. There was no burnishing or filling in needed for that purpose.

X Q. 23. Will a porcelain tooth, cast around with melted tin, adhere to the tin when it is cool, without the aid of pins or other fastening?

(Objected to as not cross-examination.)

A. No.

445 X Q. 24. Will not the tin and the porcelain shrink away from each other in cooling, so that fluids will pass between them?

A. It could not be discovered with the eye. Tin shrinks in mass and not in section.

X Q. 25. Do you mean that some part of the tin would shrink and some would not?

A. I do not. A bar of tin a foot long will shrink an eighth of an inch in its whole length, but it will not shrink at the middle and not at the ends.

X Q. 26. Won't it shrink in the same proportion in every direction as it does in its length?

A. Yes.

X Q. 27. Won't it shrink so as to permit water to pass between the teeth and the tin in the case of such a plate as you have described?

A. I never knew any water to pass.

X Q. 28. Wasn't type metal substituted for tin because it would not shrink in cooling?

(Objected to as assuming a fact not stated by the witness.)

A. Not to my knowledge.

X Q. 29. What was the object of using tin in the manner you have described?

A. To obtain weight, fullness, and cleanliness.

X Q. 30. Is it desirable to have a plate heavy if the necessary size can be made light?

A. Very desirable.

X Q. 31. Isn't a gold plate heavier than a tin one of the same size?

A. Certainly.

X Q. 32. Why did you substitute tin for gold? Is it better in itself or better for the purpose?

A. There would not be one in five hundred that would pay for it.

X Q. 33. Then was not cheapness the object of using tin instead of gold?

A. Not altogether.

X Q. 34. What other advantage besides cheapness has tin over gold for that purpose?

A. More easily obtained, more easily manipulated, and impossible to use gold for such purpose.

446 X Q. 35. Isn't the case of manipulating it and ease in getting it a mere question of expense?

A. No.

X Q. 36. Can't you get as much gold as you need for plates if you pay for it as easily as you can get tin enough if you pay for that?

A. Certainly.

X Q. 37. Is there something about a dental plate which gold cannot be used for, and which makes it desirable to find some other material more easily worked?

A. Certainly. For this process.

X Q. 38. Cannot a gold plate be made like the plate produced by the process you have described? And, if not, why not?

A. The degree of heat that it takes to fuse gold would ruin the teeth and be perfectly impracticable in the dentist's hands.

X Q. 39. Is it desirable to have the plates of the form which the process you have described would produce?

A. Exceedingly desirable.

X Q. 40. Did the use of tin practically afford to the profession a successful means of getting that form which is so exceedingly desirable?

A. To the best of my knowledge it did in the most simple and practical manner.

X Q. 41. Did that go into general use into the profession; and, if so, who used it, when and where to your knowledge?

A. I can't tell how extensively. I know Dr. George Schaffer used it. I have no knowledge when he used it or where he used it. Dr. Royce, of Newburg—I can't recall his Christian name—I can't tell when or where he used that; it was before 1850. There are others that used it that I can't recall their names now.

X Q. 42. How do you know that Dr. Schaffer used it, if you don't know when or where he used it?

A. Because he showed me a piece that he said he constructed.

X Q. 43. When and where was that?

A. It was before the 1st of May, 1851. I can't give you any nearer time than that. It was in Mr. Jones's dental depot in Broadway, near Chambers street.

X Q. 44. Was that a gold plate with a tin mass on it?

A. No, sir; silver plate with a tin mass on it.

X Q. 45. How do you know that Dr. Royce used it?

447 A. For the reason that in 1851 I visited Dr. Royce to examine his cases of that kind then in use in mouth.

X Q. 46. Were they gold plates with tin mass upon them?

A. One of them was.

X Q. 47. Were you the inventor of this use of tin, or was it known by others before you used it?

A. To the best of my knowledge I was the inventor of it in the city. Others seeing the necessity of the case, their mind led in that way, naturally came to the same conclusions, and I found Dr. Royce had preceded me in its use some years.

X Q. 48. Did you consider the use of tin to fill up on the gold plate a useful and valuable invention when it was made?

A. Not more so than upon silver or on tin alone to supply the deficiency caused by absorption, when needed. I considered it a very valuable invention.

X Q. 49. Is it used now?

A. I should think not much.

X Q. 50. Do you know of any case where it is now used, or where it has been used for the last ten years?

A. Yes.

X Q. 51. Where is that?

A. That one, Exhibit George E. Howes, No. 2, has been used.

X Q. 52. When was that made?

A. I think in 1850.

X Q. 53. Do you know of any such thing being made within the last ten years? If so, who made it?

A. I don't know of any.

X Q. 54. How many such things as Exhibit George E. Hawes, No. 2, did you ever know to have been made?

A. Two, certainly, and I should think five hundred others.

X Q. 55. Out of the five hundred others, can't you fix certainly one other than two?

A. Yes.

X Q. 56. Who made that, and who had it, and when was it made?

A. Dr. Royce, of Newburg, made it. Don't know who had it, and it was made before 1851.

X Q. 57. Was that the one you referred to in a former answer in this examination, that you saw when you visited Dr. Royce?

(Objected to as assuming that the witness has stated that he saw but one piece when he visited Dr. Royce.)

448 A. Yes.

X Q. 58. Was that like this Exhibit No. 2, or was it a compound of a gold or silver plate and tin piled on it?

(Same objection.)

A. Well, I can't give an answer to such an irregular question as that.

X Q. 59. Do you know what kind of plate you saw when you visited Dr. Royce?

A. I do.

X Q. 60. Was it like Exhibit 2, or was it composed of a sheet-metal base with a tin mass piled on it, as you have heretofore described?

A. It was like what I have heretofore described, with a gold base.

X Q. 61. Now, out of the five hundred like Exhibit 2, which you suppose have been made, can you tell where one other has been made, and who made it?

A. Yes, sir.

X Q. 62. Who made it, and where and when?

A. Dr. George Schaffer, prior to 1851. I don't [know] where. I saw it in the place I mentioned above.

X Q. 63. Was that like Exhibit 2, or had it a sheet-metal base?

A. A sheet-metal base of silver.

X Q. 64. Can't you, out of the five hundred others, fix one made like Exhibit 2?

A. Yes.

X Q. 65. Who made it; when and where?

A. Made in 1850, in Park Place, No. 8, by myself.

X Q. 66. Wasn't that one of the two you have already mentioned?

A. I think not.

X Q. 67. Which are the two that you referred to, and of which you said you were certain that two had been made?

A. Exhibit 2 is one of them, and the other one was made in Park Place by myself.

X Q. 68. What became of it?

A. I think it is in Greenwood Cemetery.

X Q. 69. Did that have a sheet-metal base?

A. No.

X Q. 70. Did the third one you have mentioned have a sheet-metal base?

449 A. No.

X Q. 71. What became of it?

A. It is in Wrentham, Norfolk County, Massachusetts.

X Q. 72. In whose possession?

A. My mother's.

X Q. 73. When was it made?

A. In 1849 or 1850. I can't tell.

X Q. 74. Has that been in use ever since?

A. No.

X Q. 75. Has it been superseded by some other plate?

A. No, sir.

X Q. 76. When was its use abandoned by your mother?

(Objected to, as assuming an abandonment which the witness has not testified to.)

A. I don't know.

X Q. 77. Do you know how long she ever used it?

A. Seven or eight years.

X Q. 78. Out of the four hundred and ninety-six others, can you fix one other like Exhibit 2: if so, who made it, when and where?

A. I suppose I could by thinking them up, but I am too tired and hungry to think them up.

X Q. 79. In your present state of mind and body are you able to say that you made another like Exhibit 2; and, if so, when did you make it, and for whom?

A. Yes, I made another. I made it in 1849, in Wrentham, Massachusetts. for Rev. Elisha Fisk, deceased.

X Q. 80. Did that have a sheet-metal base?

A. No, sir.

X Q. 81. Are you able now to say that you made another such? If so, when and where?

A. No, I don't feel equal to it.

X Q. 82. During those years from 1838 to 1855, were you not actively engaged as a dentist?

(The word "those" objected to.)

A. Yes.

X Q. 83. When did you begin to make vulcanite plates?

A. I never made one.

X Q. 84. Have you never used them in your profession?

A. Yes.

X Q. 85. When did you begin to use them, if you never made them yourself?

450 A. I can't recollect.

X Q. 86. Why did you use them when you knew all about these tin plates, and had made them yourself?

A. Because I considered them better.

X Q. 87. Didn't you consider them a useful and valuable improvement on what had gone before them, and don't you now so consider them?

A. I do.

X Q. 88. Has there been any improvement in the dental art, within your experience, as great as the improvement effected by the use of the vulcanite plate; if so, what other improvement is equal to it?

(Objected to, as incompetent and irrelevant.)

A. The use of the vulcanite for dental purposes is the greatest improvement in my profession that I know of for the last twenty-five years. It is altogether inferior to a base of tin where weight is essential. It falls far below the invention of continuous gum work on platina in usefulness where weight is essential. Vulcanite may be used by dentists in many ways which could not be accomplished by tin or platina.

X Q. 89. Is the number of cases in which a greater weight than vulcanite will afford is desirable, sufficiently large to make the substitution of tin or platina practically important in your profession?

A. The cases where it is most useful are comparatively few relative to the whole number of cases. It is more useful where absorption has gone on to a very great extent. We generally find it in old persons.

X Q. 90. In Exhibit 2 are there not pins which were used for attaching springs, whose office it was to hold the plate against the gum?

A. There were springs attached to this Exhibit 2 to hold the upper plate against the gums, but of no importance to the under set.

X Q. 91. Was this sort of plate, like Exhibit 2, useful for an upper set?

A. I never used it for such a purpose.

X Q. 92. Did you ever see it used for that purpose?

A. I have seen plates made by this process—upper plates—used for this purpose, but of a different composition.

X Q. 93. Who made them, when, and where, and of what were they composed?

451 A. I should think in 1855 or 1856, a gentleman by the name of Blandy, I think, in Baltimore, issued a circular stating that he made cast plates for the upper jaw; don't know when he made them or where he made them; don't know the composition. Saw the plates at Jones's dental depot.

X Q. 94. Did you consider these tin castings suitable for the upper jaw? If not, why not?

A. I did not at the time. I knew of no reason why they couldn't be used.

X Q. 95. Can't you tell why you thought they were not suitable for that purpose?

A. Being in the twilight of our profession at that time no one made the attempt. I presume that it was thought they could not be retained in consequence of their weight. It has since been proved by the use of platina, a much heavier metal, that such objection was unfounded. This answer refers to the upper jaw.

X Q. 96. Didn't you in 1850 publish an account of the manner in which you proposed to make these tin base artificial teeth for the purpose of introducing it to the profession? and was not that publication addressed in a letter to Dr. C. A. Harris, the editor of American Journal of Dental Science?

A. Such a letter, I think, was published at the request, I think, of Dr. Harris, not for the purpose of introducing it, but for describing one of the varied processes of constructing under sets of teeth on a tin base.

X Q. 97. Didn't you say in that letter that you were aware "that in doing this I am bringing into notice a system of practice which has hitherto been confined to a few only in our profession, and which will not probably at first view meet with general approbation, as it is yet a question in the theory of some among us whether tin is admissible in our practice for constructing dental substitutes"?

(Objected to as incompetent, such letter being the best evidence of what was said therein, and no such letter being in evidence or having been referred to in the examination-in-chief.)

A. I presume I did at that date.

(Answer objected to.)

X Q. 98. Didn't you find at that time that "sometimes certain spots required a touch of the soldering copper" after the casting had been removed from the mould?

A. Never used soldering copper.

452 X Q. 99. The question repeated.

A. Never used a soldering copper.

X Q. 100. Were the castings always perfect as they came from the mould?

A. No.

X Q. 101. Didn't you heat the material in some way or in some parts of it after it came from the mould?

A. Whenever there was a defect, certainly.

X. Q. 102. How did you apply that heat, if not with a soldering iron?

A. Sometimes in the fire, sometimes with the blow-pipe, according as circumstances required.

X Q. 103. What effect did the blow-pipe produce on the tin?

A. It made it hot.

X Q. 104. Didn't it made it soft?

A. It fused it at the point intended.

X Q. 105. Was not the effect of this fusing to make the tin run into the places which it had not filled in the mould?

(Objected to, as the witness has not stated that there were any places which the tin had not filled in the mould.)

A. No; because the defect was only exposed to the flame, the other part being covered with plaster or plaster and sand, thus protecting it same as first construction.

X Q. 106. Wasn't the object and effect of the blow-pipe treatment to supply tin where there was a deficiency as the thing came out of the mould?

A. The object and the effect was to remedy the defect.

X Q. 107. Wasn't the defect always a want of the metal where it should have been?

A. No. The defect was sometimes in manipulating the wax. Didn't satisfy the patients. Wanting more fullness here or there, as they might notice after the set was placed in the mouth.

X Q. 108. Wasn't the blow-pipe used in the first treatment of the casting before it was finished?

A. Not necessarily, if I had a good fire.

X Q. 109. Wasn't it in fact needed sometimes?

A. Certainly, to remedy defects, as I said before.

X Q. 110. Did you make Exhibit No. 3?

A. Yes, sir.

X Q. 111. Wasn't there a tool used to compress the tin around the teeth so as to make close contact between the tin and the teeth?

453 A. No tool for that purpose.

X Q. 112. Did not you use a tool which produced that effect, whatever might have been its purpose?

A. It would have produced that effect if needed, but any one can see that no tool has been used in many instances there.

X Q. 113. Isn't it apparent that the tin has been compacted between those teeth by a tool forcibly applied?

A. No.

X Q. 114. Has no tool touched that metal around the base of those teeth?

A. Yes; but not for the purpose of compacting it around the teeth, but only intended in the usual process of finishing, which is here only partly completed.

X Q. 115. Did you use that tool yourself, or was it done by another?

A. Myself.

X Q. 116. What tool was it, a cutting tool or a blunt tool?

A. I see traces of sand-paper, file, burnisher and grindstone.

X Q. 117. Is a burnisher a cutting tool or a compressing tool?

A. A compressing tool, extensively used in all plates made of silver, gold, platina or tin. It is the chief instrument used in the last finishing.

X Q. 118. Isn't tin very easily compressed by the burnisher?

A. Certainly.

X Q. 119. Wasn't the burnisher used where the tin meets the teeth in that plate?

A. I should think so. It is used in all cases of finishing.

X Q. 120. Isn't it used to compress and fill up the interstices when solder is employed in fixing teeth upon plates in the old-fashioned way? (Objected to for ambiguity.)

A. Never made a set of teeth of solder.

X Q. 121. Is no solder ever used in fixing teeth upon plates?

A. Oh, yes.

X Q. 122. Isn't the burnisher used to fill up the interstices?

A. Not to my knowledge.

GEO. E. HAWES.

Re-examination reserved.

Adjourned to Wednesday, November 5th, 1873, at 10 a. m.

454 WEDNESDAY, *November 5th*, 1873.

Present, counsel for respective parties.

Re-examination of Dr. Hawes waived by defendant.

WILLIAM A. ROYCE, being called and duly sworn as a witness in behalf of the defendant, deposes and says:

Q. 1. What is your name, age, residence, and occupation?

A. William A. Royce; 59 years of age; residence, Newburg, Orange Co., N. Y. I have two business interests; one is the occupying premises belonging to myself and brother, and the other is trucking with my son in New York.

Q. 2. Were you at any time, and, if yea, when, engaged in the practice of dentistry, and where?

A. From 1835 to 1863. Mainly employed in the practice of dentistry. At Newburg, Troy, Poughkeepsie, Fishkill Landing, and New York.

Q. 3. During what portion of this time did you practice dentistry at Newburg?

A. From July, 1836, to December, 1837, and again from 1849 to 1863, inclusive.

Q. 4. In the course of your practice as a dentist did you make artificial plates for teeth? and, if yea, of what material or substances?

A. I did make plates of gold, silver, tin, and vulcanite. Sometimes gold and tin were together; sometimes silver and tin; and sometimes all tin.

Q. 5. State how you made such base of all tin, describing the whole operation.

A. I first select a suitable wax or other plastic material, which, when warm, would render a distinct and as perfect as possible impression of the maxillary arch, gum and teeth, if any, which was to be operated upon and fitted with artificial denture. I provided next a suitable tray or wax-holder, into which the warm wax was duly bedded. Next, proceeded to introduce it to the patient's mouth, and impress the wax with the teeth and gum and arch aforesaid with a suitable impression to the extent desirable. I next proceeded to mix fine calcined plaster
455 with water to a proper consistence to pour into the said impression in wax, to obtain a good and accurate cast of the teeth, gum and arch as aforesaid. I then waited for the due hardening of the plaster, which when accomplished, I proceeded to immerse the whole cast and wax impression in tepid water, and when duly mollified I lifted out the plaster cast from the wax, thereby securing a good representative of the premises in which artificial dentures were to be adapted.

I next proceeded to take an articulation, by means of softened wax

moulded upon the cast, and lifted off and placed in the mouth of the patient for whom the operation was intended. After proper adjustment in its place, corresponding with that occupied on the cast, the patient was instructed to close the mouth and impress the wax within it, with such opposing teeth and gum as the case presented, after which the impressed wax was carefully lifted from the mouth and place on the plaster cast aforesaid. I next proceeded to add to said plaster cast either a mass of plaster or a metallic appendage, serving the purpose of showing the precise relative position of the opposing parts usually called an articulator. I next proceeded to add a cast of the opposing part to the said articulating apparatus. Next, warmed the wax as before in tepid water and duly removed it, thus exhibiting the vacancy between the jaw to be occupied with new artificial denture and the opposing jaw. I next provided a moderate layer of wax upon the first cast, and proceeded to select suitable artificial teeth to meet the antagonizing teeth; fitted them suitably for that purpose, if not found ready made. Next, lined said teeth with a suitable backing, generally gold, and soldered said backing to the teeth by means of platinum pins and a proper matallic solder. Next, proceeded to place those teeth so backed and soldered in proper position on the original cast, and flowed about them and the cast pure wax in such volume and portions as would, when substituted by tin, render the desired strength and weight and perfection of fitting to constitute the most desirable case of artificial teeth for the premises to be fitted and of the materials selected. I next poured over the whole cast and teeth such plaster, mixed with water, as would render the whole mass consolidated. Heated up the said mass to such temperature as would cause all the wax to flow out of the matrix cast around it, and dissipate such moisture as would cause an ebullition in molten tin when poured into the said matrix or mould. I also provided
suitable gates through which to pour molten tin, and permit easy
456 escape of any vapor, either of wax or of water, which might be
evolved by the heated tin when poured into said heated chamber or matrix. I next melted a suitable quantity of pure tin in a proper vessel, generally a large cook's spoon, sometimes with other vessels, and poured it in one of the gates, heretofore described, until it appeared at the opposite gate. Sometimes the investing cast of plaster was opened to the inner side of the dental arch, and a small bar of silver or of gold, duly bent and adapted, was bedded in the tin at such section of the arch as might be too weak, if entirely composed of tin, which was a rare occurrence. I next proceeded to remove all the investing plaster, trim off the gates from the casting, and with file, scrapers, burs, sand-paper, pumice-stone, brush-wheels, and chalk, used artistically, finish up and polish completely the tin base produced by the process above described.

Q. 6. When did you first use the method you have described to make a tin base?

A. In 1838.

Q. 7. Had you used that method prior to 1838 for making any other than a tin base; and if yea, what kind?

A. In 1837, with a plaster and sand combined cast, obtained as in the first described case; I proceeded with wax alone to mould a plate and appendages for a fractional lower jaw, which was duly enveloped in plaster and sand, and a gold plate, with antagonizing appendages, was cast and fitted as in the first described case.

Q. 8. In making plates of silver and tin or of gold and tin, how did you proceed, if anywise differently from the process you have described?

A. When the plaster cast of the tooth and gum is obtained, as in the

process first described, I varnished it over with shellac, the cast being first shaped so as to draw from moulding sand conveniently, and obtained in sand a good impression of said cast, which impression I duly filled with molten zinc; again with proper curb or dam around the zinc, poured molten lead upon the zinc, forming what is known in the arts as a swadge, in which the metallic plate, whether gold or silver, was duly struck and brought to a fit, properly trimmed to suit the cast and the case for which the artificial denture was prepared; the next step was to coat with a soldering copper the convex surface of said plate; next, mollified wax in proper volume was placed upon said plate and introduced to the mouth of the patient, where, as before stated, an articulating impression
457 was duly obtained; it was next, withdrawn from the mouth, and an articulating cast, as before described, obtained; whereupon a proper selection of teeth was made and adapted, after which said teeth were lined and soldered, sometimes both to plate and tooth, sometimes to tooth only, and when duly adjusted in place upon the plate, the teeth and plate were again enveloped in part with wax as in the first described instance, and treated in the same manner, tin being poured in at a gate or gates to fill the matrix formed by the molten and displaced wax. I sometimes, instead of pouring the tin, have run it in its place with a soldering iron.

Q. 9. To what extent and during what period of time have you used, with one material or another, a matrix such as you have described?

A. At all times while in practice, from August of 1838, to June, 1863.

Q. 10. Please describe your use of vulcanite with any variations, if any, in such use for dental plates, and give dates.

A. I commenced to pack vulcanite for myself in the spring of 1859, and continued to use it in my practice until June, 1863. The impressions and articulations were obtained in the manner described in the two preceding cases, after which teeth duly selected were artistically adjusted, sometimes with and sometimes without linings of gold; sometimes with and oftener without bars of gold in the weaker section of the arches. Next, I built up masses of wax beneath and around the teeth, as in the first described case; then placed plaster cast, teeth, and wax within a suitable flask and encased the teeth, external part of the arch and bottom of the cast, in a suitable body of plaster, which, when hardened, was duly varnished and oiled, and an internal fitting piece, fitting the internal part of the arch, was duly cast, and when sufficiently hardened, removed, giving access to the inside of the arch, the wax, and the teeth. The wax being duly removed in a proper state of warmth, the chamber or matrix formed by the wax was duly packed with vulcanizable rubber, or gutta-percha, the internal fitting-piece being placed in situ, and pressed, at the same time a pretty high temperature was given to the whole mass, the vulcanite was compressed into the matrix and retained, the whole being confined in a screw-clamp or flask, and properly vulcanized in a suitable vulcanizer, produced in the rough the base of vulcanite, which must needs go through a similar treatment, as the tin case, to smooth it and prepare it for the mouth. In case the gold bar, heretofore alluded to, was to be used, it was placed in the body of the vulcanite while packing.

458 Q. 11. Please describe more fully how and of what material the "internal fitting-piece fitting the internal part of the arch was cast" and applied.

A. The flask alluded to before in this description of the manufacture of vulcanite plate consisted of three parts, the bottom being a cast-iron

cup of a flaring and arched shape, the breast, a corresponding piece cast without a cap and with steady pins or slats to govern its position when brought in contact with the first piece or base; the third piece was a cap covering the breast of the flask with guiding flange; the cast and teeth, imbedded in plaster, occupied the bottom chamber and projected upwards into the breast of the flask, being so shapen, varnished, and oiled, that the internal fitting-piece pressed in soft, filled up the hollow of the arch and other vacancies existing in the breast at the time; the cap piece was placed on the top of the breast directly after pouring the soft plaster, thereby adapting itself to the internal fitting-piece, and expelling any surplus of plaster; the cap being lifted off the base, carried with it the internal fitting-piece.

Q. 12. Please describe the pins mentioned in your answer to question 5 as the means by which the backing was soldered to the tooth.

A. The pins alluded to are made of platina wire, having a solid head, swaged on one extremity, and that extremity bedded into the material of which the porcelain tooth is composed previous to vitrifaction. They are about one-twentieth of an inch in diameter and one-fourth of an inch in length, two in each tooth designed for metallic work; vulcanite work requiring double-headed pins, one or more, to each tooth.

Q. 13. Did the pins serve any other, and if yea, what purpose, when the teeth were backed, as you have stated, than to secure the backing to the teeth?

A. They served no other essential purpose.

Q. 14. Why did vulcanite work require double-headed pins?

A. Because the tooth would slowly but surely pull loose from its site in the vulcanite unless secured better than the mere bending angularly of a pin.

Q. 15. In what cases, if any, were the pins bent angularly?

A. Different manufacturers of teeth used different size and length of platinum pins. My experience proved that the stoutest wire used by any was insufficient to retain the tooth firmly in contact with me-
459 tallic lining unless soldered there, and totally fallacious when exposed to hard service unless possessed of a solid pin-head in vulcanite.

Q. 16. How long were the platinum pins by means of which the gold backing was secured to the teeth in such case as you have mentioned?

A. I generally used about one-eighteenth of an inch, and riveted it to the lining or backing, so as to retain the lining in firm contact with the porcelain before I applied gold solder, which I invariably did, consolidating both pin and lining thereby.

Q. 17. Why did you put the gold bar in the vulcanite, as you have stated you sometimes did?

A. Because, in the first instance, I distrusted the strength of vulcanite, and in the second instance I experienced a failure in some cases, which justified my distrust.

Q. 18. In what particular did you experience a failure such as you have referred to in your last answer?

A. Some of my patients broke their cases of vulcanite in two pieces, in the act of mastication.

Cross-examined by Mr. EDWARD N. DICKERSON, of counsel for complainants:

X Q. 19. When you were engaged in the operations you have described, what sort of furnace did you have for melting the metals you employed?

A. Various furnaces at different places and at different times.

X Q. 20. In the year 1837, what furnace did you use for melting your metals?

A. A blacksmith's forge, principally.

X Q. 21. Was that in your house, or in a blacksmith's shop?

A. In my premises.

X Q. 22. Was that forge constructed exclusively for the purpose of dental manufacture?

A. It was as a convenience to my business as a dentist.

X Q. 23. Was it an open blacksmith's fire that you used?

A. It was; not exclusively. Sometimes a close stove; sometimes an alcohol-lamp or a compound blow-pipe.

X Q. 24. Describe the compound blow-pipe you used, and for what purpose you used it.

A. It was a chamber containing alcohol and fitted with safety-valve, charge-valve, and a blow-off pipe; another detached chamber, containing alcohol and two large wick tubes. A vertical wick tube in the
460 second chamber being lighted and placed under the first chamber caused a vapor to escape with force through the blow-off pipe in the second chamber, which, being directed through the flame of an inclined tube and wick in the second chamber, projected a powerful blast of heat. I used it for the various purposes of a dental laboratory, heating metals, masses of encased work in plaster and sand, water, steel, solder of the various kinds, and a few other minor purposes.

X Q. 25. When you melted the gold to cast the gold plate that you made in 1837, explain the process and the apparatus you employed for that purpose.

A. So far as melting the gold was concerned, it was melted in a crucible in this forge that I had, and poured in a plaster and sand matrix.

X Q. What sort of crucible was it in which you melted gold? Describe it.

A. The crucible was a regular article, then and now constantly in market, known as the German sand and kaolan crucible. The mouth was three-cornered.

X Q. 26. Did you melt that gold in the open-forge fire?

A. I did.

X Q. 27. Did you experience no trouble in performing that operation?

A. I did not. I had a good large bellows attached to the forge, and could command any reasonable heat with a charcoal fire.

X Q. 28. Was the cast gold plate you then made homogeneous, i. e., having no other metal or material than the cast gold?

A. No different from the currency of which it was composed.

X Q. Were the teeth cast fast to the gold plate?

A. There were no teeth attached to it at all.

X Q. 29. What was it made for?

A. To masticate upon.

X Q. 30. Was the gold itself to perform the function of teeth?

A. It was.

X Q. 31. Did you carry that practice into very extensive use in your profession?

A. I made but one case in that way; but that was a success, being what is known as a fractional plate for a lower jaw to meet and oppose very long teeth in an upper jaw.

X Q. 32. Before 1850 how many sets of teeth in which the metal was melted and poured, did you manufacture?

461 A. I could give you nothing nearer than a close guess. From 50 to 100 cases.

X Q. 33. How many of these were made without a plate struck up, upon which the melted metal was afterwards poured?

A. A very limited number.

X Q. 34. What do you mean by a limited number?

A. Not more than half a dozen of simply and purely tin. I should doubt whether there were so many.

X Q. 35. Did you make more than three?

A. I am not certain. I used sometimes to manufacture for other dentists something in my line. I may have prepared some few for them. My impression is that I did; but I think half a dozen would cover the whole.

X Q. 36. Up to 1850, did you make as many as six in which the teeth were not soldered fast to a metallic plate base, and in which the filling was done by any other process than the use of soldering iron by which tin was filled up from the tip of the teeth to the lower edge of the gold plate, or otherwise, as the particular case required?

A. I poured a good many in previous to 1850, much in excess of six or three times six, I should think; not less that fifty poured cases previous to 1850.

X Q. 37. Were any of these done after the year 1841?

A. Poured cases commenced as solder, and loading on plates ready struck, as early as 1838, and was continued until 1860, at least.

X Q. 38. Did you not try an experiment in 1841, which decided all your practice from that time to 1850?

A. I tried many experiments, and found that gold and tin only were safe and appropriate jointly on the same plate in a large majority of mouths.

X Q. 39. Wasn't the practice which you adopted in 1841 in consequence of an experiment you then tried, described by you in 1850 in a printed publication in these words: "I get up my lower cases, when entire, about the thickness known as No. 30; strike the plate about $\frac{1}{16}$ to $\frac{1}{8}$ inch extra wide; curve up the edge the extra width on the outer border; coat the upper surface with pure tin, using a tinker's soldering copper and saturated muriate of zinc as flux. The teeth are next arranged so as to articulate properly; but if admissible, their lower ends
462 are broken off to permit a considerable body of tin to flow under them; line them with the same thickness of gold plate; place them in position, with wax on their lined faces; set them in plaster; and when the wax can be removed, proceed to solder them by their linings, with tin, to the plate, filing all smoothly from tip of teeth to lower edge of gold plate; remove the plaster on the outside of the teeth, and fill up the interstices and base of teeth in such quantity as pleases; file off any excess of tin anywhere; preserve a thick, smooth, border to the plate, both within and without the arch; scrape down all asperities not to be reached by the file; mat the surface with fine sand-paper; clean out the sand and burnish smoothly; then finish beautifully with flannel and chalk, which last will ever after preserve the cases cleanly, if daily used."

(Objected to, as incompetent, irrelevant, and irregular.)

A. The experiment in 1841 was decisive of the fact that there could be no proper mixture of other metals than of tin and gold, and such is intended in the allusion stated in the communication quoted. Furthermore, the communication quoted was given as a light to the profession at large, to whom the skill of heating tin at safe temperature for pour-

ing would be very difficult of communication, as they would get it either too cold or too hot, ruining the operation in either case.

X Q. 40. Does the language quoted truly state what your practice was from 1841 to 1850, or was your practice different from that statement?

(Same objection as to last question.)

A. In the essential matter of the mixture of metallic materials it states the truth. In the immaterial matter of the loading of tin it gives the handiest for common practice.

X Q. 41. The question I wish answered is, whether it stated truly your practice in respect to the loading of the plate with tin by the use of a soldering copper.

(Same objection as to last question.)

A. I had in my employment always some student or assistant, and sometimes several, some of whom were intrusted to perform one way only. When my own personal efforts were made to fit and prepare a lower jaw, I generally ran the metal in its place in a matrix, but at the time of writing this communication in 1850, as quoted, my assistants generally loaded the plates prepared in my office, and they were rarely allowed to pour them.

X Q. 42. Why were they not allowed to pour them?

463 A. For the reason previously stated, that if the tin be too hot or too cold, the operation would fail.

X Q. 43. Was it immaterial to you when you did it which method you practiced?

A. It was a saving of labor to pour the tin, and more perfect work the result.

X Q. 44. Why didn't you always then practice that method which required the least labor, and produced the best result, the advantages being all one way?

A. Because I had a full practice at the operating-chairs, and could not afford the time in the laboratory to prepare and fit a case by this process just when the case required attention in order to progress with the work.

X Q. 45. You said that you "generally ran the metal when you performed the operation; why didn't you always do it, if it was the least laborious to do, and produced the most perfect result when done?

A. Because the work could be carried forward by assistants to a stage convenient to solder the cases with tin and the soldering copper, and could not go further. The students would carry it as far as they could and then I would solder it.

X Q. 46. After the work was ready for soldering, couldn't any tinman do it, and haven't you, in your practice, sent the cases around to a tin-shop to have them soldered when they were prepared for that final operation?

A. With this qualification, that the tin-man must know that in soldering the pure tin he must guard against excessive heat; I have sent them to a certain one tinker in our city, educated not to overheat the materials, in a few instances, when I had no time to attend to them myself, or no fire to heat a copper.

X Q. 47. Then was not the same precaution needed against overheating when you soldered as when you poured?

A. Not so much caution, for the reason that the tin from the soldering copper is dribbled in drops upon the gold plates, and when an ounce or two of tin are heated and poured in at a single gate, all the metal neces-

sarily impinges on a very limited area of the plate, and if a little too hot amalgamates with the plate.

X Q. 48. Which is the scientific or artistic part of the work, the preparation of the plate and teeth before being loaded with solder, or the loading of that plate with tin and solder when so prepared?

464 A. Much the highest art is requisite in planning, setting up, grinding, and adjusting teeth, provided the outlines and fit are to be taken and effected.

X Q. 49. When the teeth were prepared for soldering had not the difficult part of the work been done?

A. The most difficult, the most tedious part at least.

Further examination adjourned to the 6th inst. at 10 a. m.

THURSDAY, *November 6th*, 1873.

Present, counsel as before.

Cross-examination of WILLIAM A. ROYCE resumed by Mr. DICKERSON:

X Q. 50. Did you think that the process of pouring melted tin was attended by such difficulties and uncertainties that it could not be prudently intrusted to men who were capable of constructing the set of teeth and preparing them ready for the tin?

A. At the time of writing that article my brother, an expert tinker, was learning the business of dentistry in my office, and he soldered all the cases that were soldered with the soldering copper very adroitly, and generally free from flaws; such work as I had time to perform myself, I succeeded in pouring with almost uniform success; did not ruin but one case and injure two or three others; similar injury was also done with the soldering copper quite as many times; an accurate statement of the fused condition of the tin previous to pouring was also furnished as a contribution to the general information intended to be imparted by the paper, with a probable bias, at least at that time, in favor of the use of the soldering copper.

X Q. 51. Cross-int. No. 50 repeated.

A. No, I did not.

X Q. 52. Did you have anybody about you, including the expert tinker, to whom you did intrust that operation?

A. I did.

X Q. 53. Who was it?

A. A student who was with me four years; his name was Richard eed.

X Q. 54. Was he the only person who could learn to do it? If not, who else?

A. No, sir; a Mr. Sanford, whose Christian name I cannot now call to mind; he is now dead.

465 X Q. 55. After the plate is prepared for loading with tin, isn't it a shorter and easier operation to load it by the use of the soldering copper, melting down a bar of block-tin, than it is to go through the operation of constructing a mould and then casting in the tin in the manner you have described?

A. It is shorter and easier to fasten the teeth; much more laborious to finish and perfect.

X Q. 56. Who did the finishing and perfecting in your practice?

A. Students and employees generally; occasionally myself.

X Q. 57. Did you ever make more than three cases in which tin was exclusively used by pouring it in a mould?

A. My impression is that I made as many as a dozen.

X Q. 58. Did you ever make any after 1850?

A. Not one.

X Q. 59. When you made the publication referred to, did you not, after stating that you had used tin twice, and after giving a particular account of those two experiments, make this statement: "I became prejudiced, however, against tin to lay on the gum, and used but one more, without plate, to lay on the gum. This third case was a tin base, in an entire upper and lower case, for a gentleman about sixty-five, whose saliva was so inert that sixteen-carat gold would not tarnish sooner than eighteen usually does. He wore, and used severely, his teeth for about two years, when I struck and fitted a gold plate of about No. 30, and stereotyped the tin on it, embracing the teeth which had been freed from their former base for this melting"?

(Objected to for the reasons stated in objections to X int. No. 39, and further as assuming that the witness made the publication referred to.)

A. I made that statement, descriptive of my own practice for my own patients. I always performed for neighboring practitioners who were themselves incapable or unprovided with the means to perform for themselves, and when I speak through memory, alluding to a dozen, I intend to include all such performance.

X Q. 60. Was the statement quoted true?

A. As far as my memory serves me, it is correct.

X Q. 61. For whom did you make the other nine cast-tin plates?

A. Several for Dr. Millspaugh, of Middletown, New York; one
466 or more for Dr. Smith, of Pine Plains, New York, according to the best of my memory.

X Q. 62. Are those gentlemen now living?

A. One is dead; I am not aware whether the other one is alive or not. I have not heard of him for ten years.

X Q. 63. Which is the one that is dead?

A. Millspaugh.

X Q. 64. What is Dr. Smith's name?

A. I can't remember.

X Q. 65. Do you know that he is not now in Pine Plains?

A. I do not.

X Q. 66. Is there any living person whose name you can give for whom you made such a casting?

A. I am not sure of the existence of any one.

X Q. 67. Why did you not make more than three of those cast-tin plates for the use of your own patients?

A. For the reason assigned, that familiar experience developed the fact that excoriated gum would corrode and render rough and unfit the tin base, although otherwise serving a very desirable purpose.

X Q. 68. Then, if I understand you, the solid tin base was found practically to be unfit for the purpose? Is that not so?

A. Yes, except in rare instances.

X Q. 69. Wasn't it very desirable to make a plate which would be cheaper than gold, and which could be moulded more conveniently and cheaply into the desired form, provided such a plate should be able to resist the destructive influences to which it would be subjected, and would not injure the mouth?

A. Most unquestionably.

X Q. 70. Was not this experiment with cast tin tried in the hope of accomplishing that object?

A. Certainly.

X Q. 71. And when it was given up by you for the reasons you have mentioned, were not your subsequent operations, in which you used a gold or silver base loaded with tin, carried on for that same purpose; that is, to cheapen the cost of gold plates?

A. The effort made with silver was limited to a petty price, less when complete than the value of the gold requisite to make a plate.

467 The other efforts with gold plate as a base loaded and soldered with tin were not for economy of cost, but for perfection and desirability of result, being a loaded lower jaw.

X Q. 72. Wasn't tin an objectionable metal in the mouth, as compared with gold?

A. Properly applied, no.

X Q. 73. How can it be applied so as to be as free from objection as gold?

A. By avoiding contact with the integuments within and without the alveolar arch.

X Q. 74. Is not tin affected by the saliva and by the acids which are taken in the mouth with food?

A. It is.

X Q. 75. Is not a piece of tin, held in the mouth, disagreeable to the taste?

A. It is, until a pellicle forms upon it, after which it is inert and tasteless.

X Q. 76. Didn't you attempt the process of gilding tin for the purpose of preventing the disagreeable effects produced by its presence in the mouth?

A. I did, and succeeded admirably, ultimately.

X Q. 77. Was not that gilding necessarily galvanic gilding?

A. Not necessarily, but with one exception, or two at most, it was the mode of application.

X Q. 78. How is it possible to gild a mass of tin otherwise than by the galvanic process?

A. By thin laminæ of gold and fusible alloy as solder, applied as silver is applied by the platers.

X Q. 79. Do you mean by that that a sheet of gold was soldered on to the pure tin base, and in that way made to protect it from the action of the saliva?

A. Yes.

X Q. 80. Didn't you melt your tin base when you soldered gold on to it?

A. I did not.

X Q. 81. Did you find the objection to tin so great that you resorted to the process of soldering gold plates over it in order to protect it from the acid?

A. I desired to produce a golden surface with the double object of the appearance of the piece and protection from excoriation or staining.

X Q. 82. Did you not make this statement in 1850, viz: "My

468 effort to coat tin with galvanic gilding were futile, as the gold very soon disappeared from the friction of aliment?"

(Same objection as to X int. No. 39.)

A. I did.

X Q. 83. Was that true?

A. At the time it was true. It isn't true to-day. I can do it very well to-day, and I tender a specimen of brass and tin galvanized, made as a mere show-case for an office, and so employed since 1851.

(Specimen referred to by witness marked for identification Royce Exhibit No. 1, Nov. 6, '73, J. A. S., ex's, at request of complainant's counsel.)

X Q. 84. Has that exhibit ever been subjected to use in the mouth so as to ascertain whether it will stand the action of the acids?

A. That is a mere show-case, made to fit no mouth, of brass.

X Q. 85. State the experiments after 1850 by which you succeeded in coating tin with gold so as to successfully protect it from the action in the mouth; when did you first succeed in accomplishing it?

A. When Smee's battery was first introduced in the city of New York by Dr. Chilton.

X Q. 86. When was that?

A. In 1850 or '51.

X Q. 87. Up to that time had your efforts in that direction failed?

A. They had, with batteries.

X Q. 88. What was the object of these efforts and experiments to coat tin with gold if it was practically unobjectionable when uncoated?

A. For the convenience and pleasure of presenting to the parts exposed, and to the eye, a neater and more admirable surface and appearance.

X Q. 89. Do they gild vulcanite plates?

A. I am not conversant with the art to-day. I gilded them sometimes.

X Q. 90. When you began to manufacture vulcanite plates, where did you get the soft compound for beginning the operation?

A. Of Dr. B. W. Franklin.

X Q. 91. Who was he and where did he live?

469 A. My impression is that he resided on Long Island. Did business about the corner of Broadway and Houston street, New York City.

X Q. 92. Wasn't he the agent of the American Hard Rubber Company?

A. He claimed an agency for some hard rubber company, but I am not sure that it was the American.

X Q. 93. Wasn't he the editor of a periodical called The Vulcanite, which was devoted to advocating the dental vulcanite plates?

A. I think he was.

X Q. 94. Did you not have that publication and read the articles in it in respect to the use of vulcanite for dental plates?

A. I have no doubt I did. I was very familiar with Franklin.

X Q. 95. Did you ever use any vulcanite except that which you obtained from him at that time?

A. I did.

X Q. 96. Where else did you get vulcanite?

A. From Dr. Roberts, in Bond street. I am not sure whether elsewhere or not.

X Q. 97. Was that the same material that you got from Franklin?

A. I couldn't discover any difference.

X Q. 98. Did you have a license from Dr. Franklin or his company for the use of vulcanite in dental plates?

A. I had a verbal contract to be supplemented with a license, and a monopoly of Orange and Dutchess Counties as to the use of vulcanite on certain contingencies.

X Q. 99. Did you agree to pay money for the privilege of using the compound for manufacturing dental plates in the territory you have mentioned?

A. I agreed to pay money for the exclusive privilege to use it in the territory named, provided the company he represented would grant and convey to me such monopoly and prevent infringement.

X Q. 100. Did you consider such a monopoly as that would have been a valuable property?

A. Unquestionably I did.

X Q. 101. Did it cost you anything for the privilege of using the tin processes you have described in the counties named, or anywhere else?

470 A. Certainly not. I invented it myself, unaware that any such attempt was ever made by any other man at that time.

X Q. 102. Didn't you consider it a valuable invention when you made it?

A. I did, and think so yet; when connected with the gold base.

X Q. 103. Didn't you consider it a valuable invention for a pure tin base simply?

A. Not of much value.

X Q. 104. Why didn't you patent the invention of using tin in the manufacture of dental plates?

A. For the reason that I did not justify any man in the profession in claiming monopoly of any device, apparatus, or thing used in his professional practice.

X Q. 105. Had you any doubt about the value and patentability of your invention?

A. I had not.

X Q. 106. Please to explain to the court the difference which you find to exist between holding a monopoly of your own invention against your brethren and buying another man's invention and holding it as a monopoly against them.

A. In buying another man's invention, who is not a professional man, or a company, who held a monopoly, as they claimed, for a very novel and desirable thing which would require much patience in introducing to an uninitiated public, I could serve the public, the inventor and myself at considerable expense, with prospect of suitable reward. My own inventions I could make a gratuity to the mass of the profession without embarrassment or expense to myself. I did not hold any monopoly in any invention of my own, and they were many.

X Q. 107. If you had bought the monopoly for vulcanite plates, would you have done so with the intention of making money out of the purchase by selling it out at a profit, or with the intention of relieving your professional brethren in those two counties of the expense of buying for themselves the right to use this valuable invention?

A. Dr. Franklin urged me to take hold of and introduce rubber vulcanite within the range of my influence among my professional brethren and the public at large. I took hold of the article slowly and with distrust, and intended to select suitable operators in the district and share with them the advantages and expense of the introduction.

471 X Q. 108. Did you consider it a difficult thing to introduce this new manufacture into use?

A. I did, and it was.

W. A. ROYCE.

Subscribed and sworn to before me this day of November, 1873.
J. A. S.

Examiner adjourned to the 7th, at 10 a. m.

FRIDAY, *November 7th*, 1873.

Present, counsel as before.

It is stipulated between counsel for the respective parties in this cause as follows:

Defendant offers and puts in evidence a license by the American Hard Rubber Company, of New York, to A. W. Todd, of Montgomery, Alabama, dated April 18th, 1860, under letters patent of the United States, granted to Nelson Goodyear, May 6th, 1851, for improvement in the manufacture of India rubber and allied gums, as reissued in two new letters patent, one of said new patents being for the new product, manufacture, or substance known as the hard compound of vulcanized caoutchouc, or India rubber, and allied gums, and the other for the improved process for producing the said product or substance, both of which said new letters patent bear date May 18th, 1858, which is marked Defendant's Exhibit No. 36.

Also a similar license to S. S. Blodgett, of Ogdensburg, New York, by the American Hard Rubber Co., under date of April 22d, 1859, which is marked Def't's Ex. No. 37.

The defendant also produces similar licenses, as follows: The American Hard Rubber Co. of Bethany, Conn., under date of February 10th, 1860, to Miller & Hale, of Rockford, Ill.; to Spencer Roberts, of Philadelphia, Penn., under date of Sept. 20th, 1859; to T. Howard Burras, of New York City, under date of January 3d, 1861; to Hawes Bro. & Seabury, of Providence, R. I., dated August 19th, 1859; to James Taylor, of Cincinnati, Ohio, December 27th, 1859.

Also similar licenses by the American Hard Rubber Co. of New York, to R. Pursell, of Nashville, Tenn., dated March 14th, 1860;
472 to C. Palmer, of Warren, Ohio, dated June 26th, 1860, and to A. E. Pursell, of Madison, Ind., dated July 28th, 1860; and it is admitted by complainants that said licenses were executed by the grantors at the respective dates above specified, and that the licensees therein named each exercised to some extent from the date of their respective licenses the rights to make and vend artificial gums or plates for artificial teeth of hard rubber or vulcanite conferred by said licenses. Said licenses being similar to Def't's Ex. No. 36, are not made a part of the record, simply to avoid cumbering the same.

The complainants make the foregoing admissions for the sole purpose of saving expense and trouble of making formal proof of the execution and contents of said licenses, but reserving all objections as to the competency or relevancy, as evidence in this cause, of the facts so admitted.

JAHIAL PARMLY, being called and duly sworn as a witness in behalf of the defendant, deposes and says:

Q. 1. What is your age, residence, and occupation?

A. I was 66 years of age last August. I reside at No. 307 West 29th st., N. Y. City. I am a dentist. My office is at No. 19 West 9th st., N. Y. City. I have practiced dentistry since 1830.

Q. 2. In the course of your practice as a dentist have you used at New York City hard rubber or vulcanite in the manufacture of dental plates; and, if yea, during what period of time?

A. I have, from 1858 to 1868. July 15th, 1858, I used it first; stopped using it in April, 1868.

Q. 3. During this period, between 1858 and 1868, to what extent did you make such plates?

A. To some considerable extent; gold always predominated in number of pieces. I made more of gold than I did of rubber.

Q. 4. Please describe the process used by you in making those rubber plates.

A. I proceeded, when I made them, just as though I was going to make a gold plate. When I got the male and female cast I then struck a swadged tin plate of sheet tin; then put it into the mouth and fitted it accurately to the gum; then put on wax, set the block of teeth in
473 wax, and ground or jointed them together. I made the thickness in sheet wax, the whole piece just as wanted the rubber to take its place, and then put the piece into the mouth, so that the whole of the expression of the teeth would be right, and then imbedded it in plaster. After the plaster became hard, took the plaster apart, took out the wax and the tin, all but the teeth, which were held in the plaster in the position I wanted them; put the clamp together, made of cast-iron, and then screwed on the pump, which was made of brass and filled with rubber, and then put it in a cast-iron vessel filled with water, boiling, and a fire under it to keep it boiling, and then, as the rubber in the pump got heated in the boiling water, screwed down the plunger in the brass pump on to the rubber, forced it through a hole made in the plaster mould until it filled the place which the wax and tin occupied; then unscrewed the pump, screwed a cast-iron plug in the same hole the pump occupied, then put it in the vulcanizer, made of copper, with a portion of water, about two-thirds full, then tightened the screws of the vulcanizer and put it over a heat, to raise a pressure inside the vulcanizer to a certain point, and let it remain so for one or two hours; then took it out from the vulcanizer, got off the plaster that encased it, finished it up.

Q. 5. Describe the clamp, and how you put it together before you screwed on the pump.

A. The clamp is cast in two parts; put together with small bolts, loose bolts. You can take them out when you get through, and the bolts screw those two parts together; then the screw is cut for the pump in the two halves.

Q. 6. Where was the plaster mould placed when you forced the rubber into it?

A. The plaster mould was fitted on the plaster cast from the mouth. I set it into one side of the cast-iron shell. I ran soft plaster around that plaster cast, with the wax and tin on it. I then let it harden, and then oiled it, and then put on the other part. The other part has a lid to it and a hole through it; then poured the plaster into the other part, the upper part; after the plaster hardened put it in hot water, the whole concern; as the wax softened took them apart, the cast-iron pieces; one side had the teeth in it, the other side had the plaster cast in it; cleaned out all the wax and tin, leaving the teeth sticking in the plaster; then I screwed the two pieces of cast-iron together, and screwed in the pump.

474 Q. 7. Where did you obtain this method and apparatus; or did you make it yourself?

A. I used Dr. Franklin's vulcanizer. The first pieces I ever made Dr. Putnam vulcanized for me. I do not remember his first name. I think Franklin's name was Benjamin.

Q. 8. When did you get the vulcanizer from Franklin?

A. I think in 1859.

Q. 9. Before you got the vulcanizer, how did you prepare the work which Dr. Putnam vulcanized for you?

A. Just the same as I did when I vulcanized it myself, only I took the cast to him, with the wax and tin all on it, and he ran the plaster on and encased it in the mould.

Q. 10. Give the extent in number of pieces of vulcanite work made by you, as nearly as you can state.

A. That is a pretty difficult thing to say without referring to my books. I would say ten.

Q. 11. Why did you stop using rubber in 1868?

A. Because no one wished it.

Q. 12. To what extent during this period did you make gold plates, as near as you can remember?

A. To a pretty large extent. I made more gold plates than rubber, and those who wore the rubber pieces had worn gold plates before, and they preferred gold again.

Q. 13. State whether or not a gold plate fitting to the roof of the mouth and having artificial teeth attached to it is hard and unyielding.

A. No; it has a spring.

Q. State whether or not such plate in the mouth impedes mastication and perfect articulation.

A. They are put in the mouth for the purposes of mastication; that is one of the objects. They interfere with articulation; all plates do when first put in the mouth.

Q. 14. Please state whether or not the gold plate possesses and retains in use sufficient rigidity for the purposes of mastication, at the same time being pliable enough to yield a little to the motions of the mouth.

A. Yes; it does.

Q. 15. Please state which of the two would possess the most elasticity, a gold plate or a vulcanite plate, for the same mouth.

A. Gold.

Q. 16. Give your reasons for the statements you have made in answer to the last question.

475 A. I suppose I couldn't give a better reason than forty years' experience watching the action of both in the mouth.

Cross-examined by Mr. DICKERSON:

X Q. 15. If I understand you rightly, you are of opinion that the dental vulcanite plate is not upon the whole any improvement; is that what you mean?

A. Oh, yes; it is an improvement. It is an improvement on the old ivory base.

X Q. 16. Well, upon the whole, don't you think that the inventor of of this plate, whoever he was, conferred a great benefit on his fellowmen?

A. He did something towards it.

X Q. 17. Tell the court who, within your long experience, has made so useful an improvement as the inventor of the dental vulcanite plate; and if you think there is any such person, name the invention and where it was made?

A. I think the invention of porcelain teeth, and the manufacture of them in this country, or any other country, is much greater.

Q. 18. How much did that cheapen the expense of a set of teeth?

A. Anything that is incorruptible and will last for twenty or twenty-five years is cheaper than anything that will last for five or six.

Q. 19. How much did mineral teeth cheapen the cost of a set?

A. Just as much as the railroad has cheapened the price of apples.

Q. 20. Before railroads, couldn't you buy a barrel of apples cheaper than you can now?

A. Yes, sir; and you can buy a set of teeth now cheaper than you could then.

Q. 21. Well, then, apples have gone up and teeth have gone down. Now, I want to know how much the introduction of mineral teeth has reduced the cost of a set of artificial teeth?

A. I don't know how general you mean that question—whether as personal to myself, or general.

X Q. 22. I ask how much, within your knowledge, the introduction of mineral teeth reduced the price of a set of artificial teeth?

A. Not one cent, if you mean in my practice.

X Q. 23. When were porcelain teeth invented?

A. I don't know.

476 X Q. 24. Was it since you began your profession?

A. I don't know.

X Q. 25. Whenever it was, don't you think that the substitution of porcelain for teeth formed out of ivory was a valuable and useful invention?

A. I do.

X Q. 26. When gold plates were used generally, did not the fabrication of them require a large experience and a skill which could only be acquired by long practice?

A. It required a long practice.

X Q. 27. In those days, was not the art of making gold plates that were serviceable and convenient confined to a comparatively few gentlemen in your profession?

A. No.

X Q. 28. Could dentists generally make good gold plates?

A. They always said they could.

X Q. 29. Could dentists generally make good gold plates? You know, and I want your knowledge.

A. I never examined their plates at all. They say they can do it.

X Q. 30. Was it your opinion then, or is it your opinion now, that dentists generally throughout the country could make in those days well-fitting and convenient gold plates?

A. I had great difficulty in making them good and well-fitting then, and have now.

X Q. 31. Wasn't the skill with which certain dentists could fabricate gold plates well known, and did not such men get high prices for their work in consequence of their skill?

A. Prices ranged about as they do now.

X Q. 32. In your experience, haven't you been called on to make gold plates to be substituted for others which had been made by other dentists, and which did not fit well?

A. Yes.

X Q. 33. Was that a very uncommon experience with you?

A. Not very.

X Q. 34. Has not the invention of vulcanite plates enabled thousands of persons to have useful artificial teeth, whose means would not have enabled them to incur the expense of gold ones?

A. I think it has.

X Q. 35. Don't you consider that a great benefaction to mankind, whereby both health and comfort are promoted?

(Objected to.)

477 A. I think it is.

X Q. 36. Cannot now vulcanite plates be manufactured by great numbers of persons without the expenditure of time and experience which would have been necessary to have qualified them to make gold plates?

(Objected to.)

A. I think they can.

X Q. 37. Is not this element a very important one in the reduction of the cost of artificial teeth, aside from the question of the cost of raw material employed in the manufacture of plates?

(Objected to.)

A. I think it is. I believe it is much easier made than gold plates; there can be no doubt about that.

X Q. 38. About how much worth of gold would be used for a full set of upper and lower teeth?

A. I suppose that the gold would weigh 25 or 26 pennyweights; you would lose 4 or 5 pennyweights more in working it.

X Q. 39. Do you remember now the money value of 30 pennyweights of gold?

A. When you buy it you have to pay $1.10 a pennyweight. It has been as high as $1.30.

X Q. 40. Then the cost of the gold before any labor is expended on it for a complete double set would be about $33?

A. Yes.

X Q. 41. Do you know the cost of enough vulcanite to do the same work?

A. I used to pay $4 a pound for it when I used to get it.

X Q. 42. Would the cost exceed for a double set 25 cts. of rubber?

A. I don't think it would exceed that, but it would vary with different jaws.

X Q. 43. About how much is the cost of a complete double set of mineral teeth ready for use?

A. It depends a great deal upon where you buy them, or whose make they are.

X Q. 44. I mean such as are made by S. S. White, of Philadelphia?

A. I believe they are good teeth. I believe they are the best in the market at present. They cost 20 cts. apiece with gum on them, and plain, 12 cts. Have needed for each piece 28 together.

X Q. 45. Then the materials for a double set of vulcanite plates will cost about $6, wont they?

478 A. They will, if you buy those teeth in the market, but you can get teeth for much less than that.

X Q. 46. Is not a sheet of vulcanite much more elastic and flexible than a sheet of gold of the same thickness?

A. Yes, sir, it is.

X Q. 47. Is it not more elastic and flexible than a sheet of gold one-fourth as thick?

A. I never tried them.

X Q. 48. Isn't vulcanite one of the most elastic of substances, and is it not used in the art for getting elasticity where that quality is needed, such as in corset-springs and similar uses?

(Objected to.)

A. No, I don't think it is. I never heard of its being used for corset purposes.

X Q. 49. When did you try any experiment on the elasticity of hard rubber which enables you to express that opinion that it is not a very elastic substance?

(Objected to.)

A. I have been experimenting in every possible way with it for six or eight years, perhaps ten.

X Q. 50. Then, if I understand you, you are of opinion that a thin sheet of hard rubber is not so elastic as a thin sheet of gold of the same thickness?

A. I certainly did not mean to be understood so. The rubber is much the most elastic of the two, the same thickness.

X Q. 51. Is it your experience that a thin sheet of gold, such as heavy gold leaf, when you crumple it up in your hand, reacts by its elasticity against the pressure and straightens itself out again when the pressure is removed?

A. A thick or thin piece of pure gold will stay like a piece of lead; it has no elasticity at all; neither has rubber before it is vulcanized, none to speak of, none perceptible.

X Q. 52. State to the court the experiment you practiced and by which you ascertained that a gold dental plate was more elastic and flexible than a vulcanite plate for the same mouth; give the particulars of the experiment, and the tests you employed.

(Objected to.)

A. Making the two kinds for the same mouths for ten years' practice. Making a plate of each kind for the same mouth; that is the experiment by which I found out the difference.

479 X Q. 53. Was it after or before vulcanization when you compared the two plates?

A. It was after they were finished.

X Q. 54. What test did you apply for the purpose of ascertaining which was the more elastic?

A. My own fingers.

X Q. 55. Then, if I understand you, your fingers informed you that a gold plate was more elastic than a vulcanite one?

A. Yes, after it was finished.

Redirect, reserving objections:

Q. 56. What is the quality of gold used for dental plates, as spoken of in your foregoing answers?

A. 18 carat.

The examination being closed, the witness desires to have the 19th cross-interrogatory and answer thereto read to him by the examiner, and states:

That the introduction of mineral teeth has cheapened the manufacture of artificial teeth.

JAHIAL PARMLY.

It is stipulated that the depositions of witnesses in this cause may be taken by either party before John A. Shields, of New York City, as special examiner, with the same force and effect as if taken before Kenneth

G. White, examiner, as provided in the stipulations heretofore made herein.

N. Y., November 1, 1873.

LEE & ALVORD,
Compl'ts' Sol'rs.
HENRY BALDWIN, JR.,
For Defendant.

480 *Defendant's Exhibit* 10.—*November 4th*, 1873.

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

No. 12156. 153 × ×. Sharpless Clayton, of West Chester, county of Chester, State of Pennsylvania. Securing porcelain teeth to metallic plates. (Artificial teeth.)

Rec'd June 29th, 1854.
Petition " " "
Affidavit " " "
Specification " " "
2 Drawings " " "
Model " " "
Cert. dep.
1 Cash $30 June 29th, 1854.
2 Examined 9th Dec. 1854, D. Breed.
Issue, Shugert, Dec. 20th, 1854.
4 Patented Jan. 2d, 1855, ×.
Recorded, vol. 60, page 395.

WILSON & CO.,
Washington, D. C.

D.

Papers and 1 dr. ret'd Aug 2d, 1854.
" " " " Oct. 16th, 1854.

481 *Defendant's Exhibit* 26.—*Nov. 4th*, 1873.

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office.

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this eighteenth day of April, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

F. 4, p. 455.

Whereas letters patent of the United States of America were granted and issued to Nelson Goodyear, on or about the sixth day of May, A. D. eighteen hundred and fifty-one, being for certain improvements in the manufacture of India rubber or caoutchouc, by which improvements a new and useful material was produced, commonly called hard rubber or hard compound.

And whereas the Beacon Dam Company, a joint stock corporation, organized under the statutes of the State of Connecticut, located in the town of Bethany, in the county of New Haven, in said State, are desirous of acquiring from Hy. B. Goodyear, administrator of the estate of Nelson Goodyear, deceased, a right and license to use said improvements, and of becoming interested in the manufacture of the said hard rubber;

And whereas the Beacon Dam Company has covenanted to pay Charles Goodyear a certain percentage on all sales they may make of goods manufactured under said patent;

Now, therefore, this indenture witnesseth that the said Henry B. Goodyear, administrator of the estate of Nelson Goodyear, deceased,
482 and the Beacon Dam Company, have entered into the following articles of agreement, and the parties hereto hereby respectively covenant, promise and agree to and with each other that they will truly and faithfully do and perform their respective agreements in these articles mentioned, to wit:

ARTICLE.

The said Henry B. Goodyear, adm'r, etc., grants and conveys to the Beacon Dam Company the full and exclusive right and privilege in the United States to use the improvements, means, and processes in said letters patent specified in the manufacture of the said hard rubber material, namely, in the exclusive manufacture and sale of any and all articles and materials made or composed of said hard rubber, excepting the articles of whalebone contained in license to Conrad Poppenhusen, dated 2d March, 1852; combs of all kinds, contained in license to Conrad Poppenhusen, dated 12th Jan'y, 1853; fine-tooth combs, cont'd in license to Conrad Poppenhusen, dated 30th Sept'r, 1853; whip-handles, cont'd in license to Conrad Poppenhusen, dated 26th Jan'y, 1854; canes, cont'd in license to L. P. Porter, dated 1st Jan'y, 1853; buttons, contained in license to Nicholas Williamson, Dower D. Williamson, jr., and John C. Calhoun, dated 4th May, 1854; boxes of all kinds, such as snuff, shaving, fancy, dressing, envelope, daguerreotype, and any others up to the size of one foot square, contained in license to Nicholas Williamson and Dower D. Williamson, jr., dated 9th June, 1854; Prince's fountain pen, cont'd in license to Newell H. Prince, dated 17th Oct'r, 1854; pencil, pen, and paper-holder, contained in license to Austin G. Day, dated 17th Oct'r, 1854; and all kinds of handles for table-knives and forks, including carving, butter, bread, pickle, butcher, fish, cook's, shoe, oyster, tobacco, putty, palette, cane, and machette knives, and saled spoons, cont'd in license to the Beacon Dam Co'y, dated 27th May, 1856; and pen, pocket, dirk, hunting, and surgeon's knives, and razor-handles, contained in license to the Beacon Dam Company, dated 27th May, 1856; and excepting hard rubber when made into shoes, inkstands, and parts of inkstands, and the articles included in license to Gorham D. Abbott, dated 2d July, 1856.

ARTICLE.

The Beacon Dam Company are not hereby authorized to manufacture, and they shall and will not manufacture, or sell directly
483 or indirectly any articles or materials which shall in any way interfere with the rights or business of other licenses, or the rights of H. B. Goodyear, adm'r, etc., but the Beacon Dam Company shall and will exert their influence to prevent any such interference and preserve to each license of Henry B. Goodyear, adm'r, etc., the full, unimpaired, and unmolested enjoyment of the branch or branches of business he may carry on.

That the said Beacon Dam Company will not furnish the hard compound material, in any form, to any licensee of H. B. Goodyear, adm'r, etc., who has refused or delayed the payment of their tariffs when due, after notice of such default from said H'y B. Goodyear, adm'r, etc., to said Beacon Dam Company; and that they will not grind or spread any preparation of rubber for the purpose of being vulcanized by any licensee who may have refused or failed to make payment of tariffs as above mentioned.

ARTICLE.

The Beacon Dam Company shall and will not, after written notice given by Henry B. Goodyear, administrator, etc., of his disapproval, manufacture for or sell to any person or persons who refuse or neglect to pay the stipulated tariff to said H. B. Goodyear, or who refuse or neglect to purchase and pay for the right to use the same, any articles or materials of hard rubber intended to be used in the manufacture of any articles for which letters patent of the United States shall be granted.

ARTICLE.

The Beacon Dam Company shall and will at all times admit and acknowledge the validity of said letters patent, and that said Nelson Goodyear was the true and original inventor of the invention mentioned in said letters patent and claimed by him; and they shall and will hold, treat, deem, and consider all articles and materials whatsoever which shall be manufactured by them, and in which caoutchouc, or india-rubber, or gutta purcha, or other similar gum or gums shall be ingredients or component parts, to be manufactured under this license and under said patent, and will pay the tariffs or royalty, as specified in the said Beacon Dam Company's covenants with Chas. Goodyear, up to and until the expiration of the said patent of the said Nelson Goodyear, and of all reissues, extensions, and renewals thereof.

484 And the said Beacon Dam Company shall and will stamp and mark each and every article which shall be manufactured by them with the name of Goodyear as patentee, and the date of the letters patent aforesaid, and will in all respects conform to the laws in relation to stamping and marking goods manufactured under letters patent.

ARTICLE.

It is understood and agreed by and between the parties hereto, that the license and covenants and agree'ts herein contained shall continue and endure until the expiration of said letters patent, and of any future

reissues, or any extensions or renewals thereof, and of the terms of any and all extensions or renewals thereof.

In witness whereof, the parties to these presents have hereunto set their hands and seals this twenty-second day of October, in the year one thousand eight hundred and fifty-six.

[SEAL.] H. B. GOODYEAR,
Administrator to the estate of Nelson Goodyear, deceased.

[SEAL.] THE BEACON DAM COMPANY,
By WILLIAM JUDSON,
Their Agent and Attorney.

Signed, sealed, and delivered in the presence of (the words "Inkstands and parts of inkstands, and the articles included in license to Gorham D. Abbot, dated 2d July, 1856," having been interlined in the page numbered 5 before execution)—

CHAS. GOODYEAR, jr.,
GEO. L. BRISTON,
Stockwell, Surrey.

Rec'd and recorded Dec. 1st, 1856.

485 *Def't's Exhibit 27.—Nov. 4th, 1873.*

THE G. D. V. CO., ET AL.
vs.
D. H. SMITH.

The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office.

In testimony whereof, I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed, this eighteenth day of April, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

[L. S.] J. M. THACHER,
Acting Commissioner.

R. 4, p. 27.

This agreement, made this fifteenth day of July, A. D. 1856, between Charles Goodyear, party of the first part, and Henry B. Goodyear, administrator of the estate of Nelson Goodyear, deceased, party of the second part, and Clark S. Putnam, of the city of New York, party of the third, witnesseth:

That the said parties of the first and second part, for the consideration hereinafter named, agree to assign, and by these presents do assign and transfer to the said party of the third part one undivided moiety or half part of the patent right for vulcanized rubber, to be used in dental operations or processes in manufacturing artificial teeth and plates therefor, of, in, and to the following territory, to wit, the city and county of New York, the city of Brooklyn, and Jersey City and Hoboken and Hudson City, in New Jersey.

And in consideration for such right, said party of the third part is to forthwith employ an operator or workman to prosecute experiments

486 for the purpose of introducing and using said materials or vulcanized rubber, in the manufacture of artificial teeth and plate work as aforesaid, at his own costs and expense; and when said Putnam shall cease to employ one or more workmen for aforesaid purpose, or shall cease to prosecute such experiments himself, then said right herein conveyed shall become null and void as to said Putnam, and shall revert to said parties of the first and second part.

And it is further agreed by the parties hereto that neither shall sell and assign a right or rights for using said material for aforesaid purposes within aforesaid territory without the knowledge and consent of the other, and that the nett profits of each sale or sales, if any, shall be divided as follows, to wit: The one-half part thereof to said Putnam, and the one-half part thereof to said parties of the first and second part.

In witness whereof, we have hereunto affixed our hands and seals the day and year first above written.

CHARLES GOODYEAR, [L. S.]
By W. C. DEFORREST.
H. B. GOODYEAR,
Administrator of the Estate of Nelson Goodyear.
W. C. DEFORREST.
CLARK S. PUTNAM.

Witnesses:
L. S. SCOTT.
JNO. W. SPEAR.

Rec'd 1st and recorded 25th January, 1858.

487 *Def't's Exhibit* 28.—*Nov. 4th*, 1873.

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office.

In testimony whereof, I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed, this eighteenth day of April, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

U 5, p. 117.

Whereas letters patent of the United States were, on the 6th day of May, 1851, granted by the United States unto Nelson Goodyear, for a new and useful improvement in the manufacture of india-rubber, which said letters patent were reissued in two patents by Henry B. Goodyear, as administrator of the estate of said Nelson Goodyear, on the 18th day of May, 1858; and

Whereas Henry B. Goodyear, as administrator of the estate of said Nelson Goodyear, deceased, and Charles Goodyear, did assign and trans-

fer, on the 15th day of July, 1856, unto Clark S. Putnam, a one undivided moiety or half part of the patent right for vulcanized india-rubber, to be used in dental operations or processes in manufacturing artificial teeth and plates therefor, in the city and county of New York, the city of Brooklyn, and Jersey City and Hoboken and Hudson City in New Jersey; and

Whereas B. W. Franklin, of the city and county of New York, is desirous of acquiring all my interests therein:

488 Now this agreement witnesseth, that I, the said Clark S. Putnam, for and in consideration of the sum of one dollar, to me in hand paid, the receipt whereof is hereby acknowledged, and certain other valuable considerations, have assigned, sold, and set over, and do by these presents assign, sell, and set over unto the said Franklin, all the right, title, and interest which I have in and to the said letters patent and invention thereby secured and reissues thereof, as the same was transferred and assigned to me as aforesaid.

The same to be held and enjoyed by the said Franklin to his own use and behoof, and for the use and behoof of his legal representatives, as fully and entirely as I might have or hold the same had this instrument not been executed, to the full end of the term for which said letters patent are or may be granted.

In witness whereof I have hereunto set my hand and seal the twenty-eighth day of May, A. D. 1860.

C. S. PUTNAM. [L. S.]

In presence of—
HENRY W. SPENCER.
GEO. HUTTON.
L. S. BACON.

UNITED STATES CONSULATE,
City of Paris, Empire of France.

Be it known that on this twenty-eighth day of May, A. D. one thousand eight hundred and sixty, before me, Henry W. Spencer, consul of the United States of America, residing at Paris, France, personally appeared Clark S. Putnam, well known to me to be one of the parties described in, and who executed the foregoing instrument of writing, and acknowledged that he executed the same for the uses and purposes therein mentioned.

In testimony whereof, I have hereunto set my hand and official seal, at Paris aforesaid, the day and year above written.

[L. S.] HENRY W. SPENCER,
United States Consul.

Rec'd and recorded June 16th, 1860.

489 *Def't's Exhibit* 29.—*Nov. 4th*, 1873.

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office.

In testimony whereof, I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this eighteenth day of April, in the year of our Lord one thousand eight

hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

[L. S.] J. M. THACHER,
Acting Commissioner.

U 5, p. 119.

Whereas letters patent of the United States were, on the 6th day of May, 1851, granted by the United States unto Nelson Goodyear for a new and useful improvement in the manufacture of india-rubber, which said letters patent were reissued in two patents by Henry B. Goodyear, as administrator of the said Nelson Goodyear, on the 18th day of May, 1858; and

Whereas Henry B. Goodyear, as administrator of the estate of said Nelson Goodyear, did assign and transfer, on the 15th day of July, 1856, unto Clark S. Putnam, a one undivided moiety or half part of the patent right for vulcanized india-rubber, to be used in dental operations or processes in manufacturing artificial teeth and plates therefor in the city and county of New York, the city of Brooklyn, and Jersey City and Hoboken and Hudson City, in New Jersey; and

Whereas the said Clark S. Putnam did, by his deed of assignment bearing date the 28th day of May, A. D. 1860, assign, sell and set over unto Bradley W. Franklin all the right, title and interest which he, the said Putnam, had in the said letters patent and invention thereby secured, and the reissues thereof; and

Whereas the America Hard Rubber Company, of the State of New York, are desirous of acquiring all my interests therein:

490 Now this agreement witnesseth that I, the said Bradley W. Franklin, for and in consideration of the sum of one dollar to me in hand paid, the receipt whereof is hereby acknowledged, and certain other valuable considerations, have assigned, sold and set over, and do by these presents assign, sell and set over unto the said American Hard Rubber Company all the right, title, and interest which I have in and to the said letters patent and invention thereby secured, and reissues thereof, as the same was transferred and assigned to me as aforesaid.

The same to be held and enjoyed by the said American Hard Rubber Company to their own use and behoof, and for the use and behoof of their successors or assigns, as fully and entirely as I might have or hold the same had this instrument not been executed, to the full end of the term for which said letters patent are or may be granted.

In witness whereof I have hereunto set my hand and seal this fifteenth day of June, A. D. 1860.

BRADLEY W. FRANKLIN. [L. S.]

In presence of—
GEO. W. L. GAGER.
GEO. D. SARGENT.

Rec'd and recorded June 16th, 1860.

Def't's Exhibit 30.—*Nov. 4th*, 1873.

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the record of this office.

In testimony whereof, I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this eighteenth day of April, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

491 U. 8, p. 292.

Whereas letters patent of the United States were granted unto Nelson Goodyear, bearing date of May 6th, 1851, for an improvement in the manufacture of India-rubber and allied gums;

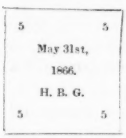
And whereas, the said letters patent were surrendered by Henry B. Goodyear, administrator of Nelson Goodyear, deceased, and reissued to him on the 18th day of May, 1858, in two divisions;

And whereas, the last-mentioned patents were extended to the said Goodyear, administrator, for another term of seven years from the 6th day of May, 1865:

Now this agreement witnesseth that the said Henry B. Goodyear, administrator of Nelson Goodyear, in consideration of the sum of two hundred and fifty thousand dollars to him paid by the Goodyear Dental Rubber Company, a corporation duly organized according to the laws of the State of Massachusetts, the receipt whereof is hereby acknowledged, hath granted, sold and assigned and doth hereby grant, sell and assign to the said Goodyear Dental Rubber Company, their successors and assigns, the full, free and exclusive right, license, and privilege to make, use and vend the aforesaid inventions of Nelson Goodyear, as applied to dentistry and for dental purposes, within and for the New England States, and for and during the whole term of said extended letters patent from the 6th of May, 1865; and for the consideration aforesaid, the said Henry B. Goodyear does hereby sell and assign to said Goodyear Dental Rubber Company the right to demand, sue for, and collect all damages for infringements of said letters patent since the 6th day of May, 1865, by any person within the New England States aforesaid. For the considerations aforesaid, the said Goodyear covenants and agrees that he has a good right and title to sell and convey the right and license aforesaid, and the right to collect damages for infringements as aforesaid, and that no other person or persons has any right, license, or privilege to use said invention within said New England States, or to collect such damages. And for the consideration named, the said Henry B. Goodyear covenants and agrees that said company shall have a right to use his name in all proceedings at law and equity for the purpose of enforcing and protecting the rights and privileges hereby conveyed. And he further covenants and agrees that he will not, and his successors shall not, grant or convey to any other

492 person any right, license, or privilege to use said invention within the New England States in its application to dentistry or

dental purposes. And for the consideration aforesaid, the said H. B. Goodyear covenants and agrees that said company and their licensees shall have the right within the New England States to use all inventions and improvements in the manufacture of rubber as applied to dentistry, or for dental purposes, which he personally owns, or may hereafter acquire in his own right.



In witness whereof, I, the said Henry B. Goodyear, have hereunto set my hand and seal this thirty-first day of May, 1866.

H. B. GOODYEAR, [L. S.]
Administrator of the Estate of Nelson Goodyear, dec'd.

Witness:
A. VAN WAGENEN,
A. POLLOK.

Recorded Oct. 6th, 1866.

Def't's Exhibit 31.—*Nov. 4th*, 1873.

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

The United States Patent Office, to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office.

In testimony whereof, I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed, this eighteenth day of April, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

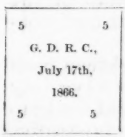
[L. S.]

J. M. THACHER,
Acting Commissione .

493 U 8, p. 294.

Know all men by these presents, that the Goodyear Dental Rubber Company, a corporation duly organized under the general laws of Massachusetts, in consideration of the sum of two hundred and fifty thousand dollars, to them paid by Sam'l A. Duncan, have sold, transferred, and assigned, and by these presents do sell, transfer, and assign to said Duncan, his heirs, administrators, and assigns, the agreements and license for the use of hard rubber for dental purposes made by Henry B. Goodyear, administrator, to the Goodyear Dental Rubber Co., and dated May 31st, A. D. 1866, which agreement and license may be referred to as part of this assignment. To have and to hold the agreement and license aforesaid, and all the rights and privileges thereby conveyed to him, the said Duncan, his heirs, administrators, and assigns forever.

In witness whereof, the said Goodyear Dental Rubber Company have caused their corporate seal to be affixed and these presents to be subscribed by Henry F. Durant, esq., their president, who is duly authorized thereto by a vote of this corporation this seventeenth day of July, A. D. 1866.



[L. S.] GOODYEAR DENTAL RUBBER CO.,
HENRY F. DURANT,
President.

Signed, sealed, and delivered in the presence of—
JOHN G. TAPPAN.
Recorded Oct. 6th, 1866.

494 *Def't's Exhibit* 32.—*Nov. 4th*, 1873.

THE G. D. V. CO. ET AL
vs.
D. H. SMITH.

The United States Patent Office, to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office.

In testimony whereof, I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed, this eighteenth day of April, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

[L. S.] J. M. THACHER,
Acting Commissioner.

V 8, p. 270.

Memorandum of an agreement made and entered into this twenty-eighth day of April, 1866 (eighteen hundred and sixty-six), by and between Henry B. Goodyear, of New Haven, in the State of Connecticut, administrator of the estate of Nelson Goodyear, deceased, party of the first part, and the American Hard Rubber Co., of Queens County, a corporation duly organized under the laws of the State of New York, party of the second part.

Whereas, an agreement dated the eleventh day of March, eighteen hundred and sixty-five, between the said Henry B. Goodyear, administrator, etc., on the one part, and Messrs. Poppenhusen & Konig on the other, among other things stipulates that instead of any tariff or royalty to be paid by the said American Hard Rubber Company, under the then existing license for the application of dentistry of the invention for which letters patent of the U. S. were issued to Nelson Goodyear on the sixth day of May, eighteen hundred and fifty-one, and reissued in two divisions to the said Henry B. Goodyear, as administrator, etc., on the eighteenth day of May, eighteen hundred and fifty-eight, the
495 party of the first part, as administrator, etc., or his assigns, shall in the event of the said patents being extended for another term of seven years from the sixth day of May, eighteen hundred and sixty-five, hold during such extended term forty-five per centum of all the interest in the exclusive use of the said invention, as applied to dentistry;

And whereas the said Poppenhusen and Konig have made and entered into the said agreement on their own behalf and on behalf of the said American Hard Rubber Company, with the knowledge and concurrence of the said company;

And whereas, by an agreement dated February second, eighteen hundred and sixty-six, the said American Hard Rubber Company have duly ratified the said agreement of the eleventh day of March, eighteen hundred and sixty-five, between the said Henry B. Goodyear, administrator, etc., and the said Poppenhusen and Konig;

And whereas, in pursuance of the said agreements, it is deemed expedient to divide the said interest territorially, so that each party may have the full and exclusive right to make, use, and vend the said invention, as applied to dental purposes, in such part of the United States of America as may be agreed upon as the equivalent of the respective interests:

Now, therefore, be it known that for and in consideration of the premises and of one dollar lawful money of the United States, by each to the other paid, the receipt of which is hereby acknowledged, the parties to these presents have agreed as follows, viz:

First. That the full and exclusive right to the said invention, as patented and as applied to denistry, in that portion of the United States which comprises the States known as the New England States, Maryland, Ohio, Kentucky, Tennessee, Mississippi, Louisiana, Arkansas, Illinois, Michigan, the District of Columbia, and all such States and Territories as are or may be west of the Rocky Mountains, shall be deemed to represent forty-five hundredths of the whole interest; and the remainder, that is to say the States of New York, New Jersey, Pennsylvania, Delaware, East and West Virginia, North and South Carolina, Alabama, Georgia, Florida, Texas, Indiana, Iowa, Wisconsin, Minnesota, Missouri, and all other States and Territories not named, lying east of the Rocky Mountains, shall be deemed to represent fifty-five hundredths of the whole interest.

Second. The said party of the first part, as such administrator, or his successor or assigns, shall have the full and exclusive right to
496 and enjoyment of the said patents, as applied to dentistry, in the States and Territories hereinbefore named as representing the forty-five hundredths of the whole interest.

Third. The said party of the second part, its successors or assigns, shall have the full and exclusive right to and enjoyment of the said patents, as applied to dentistry, in the States and Territories hereinbefore named as representing the fifty-five-hundredth part of the whole interest.

5 5 28 April, 1866. H. B. G. 5 5

In witness whereof the parties to these presents have hereunto set their hands and seals the day and date above written.

5 5 April 28, 1866. H. B. G. 5 5

[L. S.] AMERICAN HARD RUBBER CO.
OF QUEENS COUNTY,
Per D. M. ROPES, *Ag't.*
H. B. GOODYEAR, [L. S.]
Administrator of the estate of Nelson Goodyear, deceased.

In presence of—
JAMES C. HADDEN.
CHARLES H. BEDELL.

Recorded Jan. 2d, 1867.

Def't's Exhibit 33.—*Nov.* 4th, 1873.

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office.

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this eighteenth day of April, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

497 U. 8, p. 295.

Whereas letters patent of the United States were granted unto Nelson Goodyear, bearing date of May 6th, 1851, for an improvement in the manufacture of India-rubber and the allied gums;

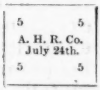
And whereas said letters patent were surrendered by Henry B. Goodyear, administrator of Nelson Goodyear, deceased, and reissued to him on the 18th day of May, 1858, in two divisions;

And whereas the last-mentioned patents were extended to the said Goodyear, administrator for another, the term of seven years from the 6th day of May, 1865;

And whereas the American Hard Rubber Company of Queens County, a corporation duly organized under the laws of the State of New York, are the owners of the full and exclusive right to the said invention as patented and as applied to dentistry in that portion of the United States which comprises the States of New York, New Jersey, Pennsylvania, Delaware, East and West Virginia, North and South Carolina, Alabama, Georgia, Florida, Texas, Indiana, Iowa, Wisconsin, Minnesota, Missouri, and all other States and Territories not already conveyed to H. B. Goodyear, and lying east of the Rocky Mountains:

Now this agreement witnesseth that the said Hard Rubber Company, in consideration of the sum of one dollar to them paid by Samuel A. Duncan, of Boston, Massachusetts, and for other valuable considerations, the receipt whereof is hereby acknowledged, hath granted, sold, and assigned, and doth hereby grant, sell, and assign to the said Duncan, his heirs, administrators, and assigns, the full, free, and exclusive right, license, and privilege to make, use, and vend the aforesaid invention of Nelson Goodyear, as applied to dentistry and for dental purposes, within and for the States of New York, New Jersey, Pennsylvania, Delaware, East and West Virginia, North and South Carolina, Alabama, Georgia, Florida, Texas, Indiana, Iowa, Wisconsin, Minnesota, Missouri, and within and for all other States and Territories not already conveyed to H. B. Goodyear, and not named, lying east of the Rocky Mountains; and for and during the whole term of said extended letters patent from the 6th day of May, 1865, and for the consideration aforesaid, the said Hard Rubber Co. does hereby sell and assign to the said Duncan, his heirs, administrators, and assigns, the right to demand, sue for, and collect all damages for infringements of said letters patent since the 6th day of May, 1865, by any person within the States and
498 Territories aforesaid. For the consideration aforesaid, the said Hard Rubber Company covenants and agrees that they have a good right and title to sell and convey the right and license aforesaid, and the right to collect damages for infringements as aforesaid, and that no other person or persons have any right, license, or privilege to use the said invention within the said States and Territories, or to collect such damages. And for the consideration named the said Hard Rubber Company covenants and agrees that Duncan, his heirs, administrators or assigns, shall have a right to use their name in all proceed-

ings as law and equity, should it be deemed necessary for the purpose of enforcing and protecting the rights and privileges hereby conveyed; and they further covenant and agree that they will not, and their successors shall not, grant or convey to any other person any right, license, or privilege to use said inventions within the States and Territories named in its application to dentistry or dental purposes.



In witness whereof the Am. Hard Rubber Company of Queens Co., by their secretary, have hereunto set their hand and seal this 24th July, 1866.

[L. S.] AMERICAN HARD RUBBER CO.
OF QUEENS COUNTY,
By ADOLPH POPPENHUSEN,
Sec'vry.

Witness:
C. W. GRAEF.
Recorded Oct. 6, 1866.

499 *Def't's Exhibit* 34.—*Nov. 4th*, 1873.

THE G. D. V. Co.
vs.
D. H SMITH.

The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office.

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this eighteenth day of April, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

[L. S.] J. M. THACHER,
Acting Commissioner.

U. 8, p. 297.

Whereas letters patent of the United States were granted unto Nelson Goodyear, bearing date of May 6th, 1851, for an improvement in the manufacture of India rubber and the allied gums;

And whereas said letters patent were surrendered by Henry B. Goodyear, administrator of Nelson Goodyear, deceased, and reissued to him on the 18th day of May, 1858, in two divisions;

And whereas the last-mentioned patents were extended to the said Goodyear, administrator, for another term of seven years from the 6th day of May, 1865;

And whereas the said Henry B. Goodyear is the owner of the full and exclusive right to the said invention as patented and as applied to dentistry in that portion of the United States which comprises the States of Maryland, Ohio, Kentucky, Tennessee, Mississippi, Louisiana, Arkansas, Illinois, Michigan, the District of Columbia, and all such States and Territories not belonging to the Am. Hard Rubber Comp. as are or may be west of the Rocky Mountains:

Now this agreement witnesseth, that the said Henry B. Goodyear,

500 administrator of Nelson Goodyear, in consideration of the sum of one hundred and twenty-five thousand dollars, by Samuel A. Duncan, of Boston, Mass., to him paid, and for other valuable considerations, the receipt whereof is hereby acknowledged, hath granted, sold, and assigned, and doth hereby grant, sell, and assign to the said Duncan, his heirs, administrators, and assigns, the full, free, and exclusive right, license, and privilege to make, use, and vend the aforesaid invention of Nelson Goodyear as applied to dentistry, and for dental purposes within and for the States of Maryland, Ohio, Kentucky, Tennessee, Mississippi, Louisiana, Arkansas, Illinois, Michigan, the District of Columbia, and for all such States and Territories not belonging to the Am. Hard Rubber Co. as are or may be west of the Rocky Mountains; and for and during the whole term of said extended letters patent from the 6th day of May, 1865; and for the consideration aforesaid the said Henry B. Goodyear does hereby sell and assign to the said Duncan, his heirs, administrators, and assigns, the right to demand, sue for, and collect all damages for infringements of said letters patent since the 6th day of May, 1865, by any person within the States and Territories named. For the consideration aforesaid the said Henry B. Goodyear covenants and agrees that he has a good right and title to sell and convey the right, license aforesaid, and the right to collect damages for infringements as aforesaid; and that no other person or persons have any right, license, or privilege within the said States and Territories, or to collect such damages. And for the consideration named, the said Henry B. Goodyear covenants and agrees that the said Duncan, his heirs, administrators, or assigns, shall have a right to use his name in all proceedings at law and equity for the purpose of enforcing and protecting the rights and privileges hereby conveyed. And he further covenants and agrees that he will not, and his successors shall not, grant or convey to any other person any right, license, or privilege to use said invention within the aforesaid States and Territories in its application to dentistry or dental purposes. And for the consideration aforesaid, the said Henry B. Goodyear covenants and agrees that the said Duncan, his heirs, administrators, or assigns, shall have the right within the States and Territories hereinbefore named to use all inven-

5 5
July 24th,
1866.
H. B. G.
5 5

5 5
July 24th,
1866.
H. G. B.
5 5

501 tions and improvements in the manufacture of rubber as applied to dentistry or for dental purposes which he personally owns or may hereafter acquire in his own right.

In witness whereof I, the said Henry B. Goodyear, have hereunto set my hand and seal this 24th day of July, 1866.

[L. S.] HENRY B. GOODYEAR,
Administrator of the Estate of Nelson Goodyear, dec'd.

Witness:
A. POLLOK.

Recorded Oct. 6th, 1866.

Def't's Exhibit 35.—*Nov. 4th*, 1873.

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office.

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this eighteenth day of April, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

F. 10, p. 357.

Whereas letters patent of the United States were granted to Nelson Goodyear, bearing date May 6th, 1851, for an improvement in the
502 manufacture of India rubber and the allied gums; and whereas said letters patent were surrendered by Henry B. Goodyear, administrator of Nelson Goodyear, deceased, and reissued to him on the eighteenth day of May, 1858, in two divisions; and whereas the last-mentioned patents were extended to the said Henry B. Goodyear, as administrator, for another term of seven years, from the 6th day of May, 1865; and whereas Samuel A. Duncan, late of Boston, Massachusetts, became, July 17th, 1866, the owner by mesne assignments and conveyances of the full and exclusive right to the said invention as patented and applied to dentistry in and throughout the United States:

Now this indenture witnesseth, that the said Duncan, in consideration of the sum of one dollar, to him paid by the Goodyear Dental Vulcanite Company, a corporation duly organized and established under the laws of the State of New York, and for other valuable consideration, the receipt of which is hereby acknowledged, hath granted, sold, and assigned, and doth hereby grant, sell, and assign to the said Goodyear Dental Vulcanite Company, their successors and assigns, the full, free and exclusive right, license and privilege to make, use and vend the aforesaid invention of Nelson Goodyear, as applied to dentistry and for dental purposes, within and throughout the United States, and for and during the whole term of said extended letters patent, from the sixth day of May, 1865; and for the consideration aforesaid the said Duncan doth hereby sell and assign to the said Goodyear Dental Vulcanite Company, their successors and assigns, the right to demand, sue for and collect all damages and profits due at law and in equity for infringements of said letters patent in their application to dental uses since the seventeenth day of July, 1866, by any person within the States and Territories aforesaid, together with the right to prosecute to final issue the suits now pending in equity, in the name of Henry B. Goodyear and S. A. Duncan, for infringement of said letters patent, and to all interlocutory remedies in said suits, and to the monies to be therein recovered and all monies due or to become due under any and all licenses to use said invention which have been executed since said date.

And for the consideration named the said Duncan covenants and agrees that the said Goodyear Dental Vulcanite Company, their successors and assigns, shall have the right to use his name in all
503 proceedings in law and in equity, should it be deemed necessary for the purpose of enforcing or protecting the rights and privileges hereby conferred.

In witness whereof the said Samuel A. Duncan has hereunto set his hand and seal this seventh day of January, anno Domini one thousand eight hundred and sixty-eight.

5 5
S. A. D.
Jan. 7th, 1868.
5 5

[L. S.] SAM'L A. DUNCAN.
D. E. CASET.
J. W. MAN.

Recorded March 2d, 1868.

Def't's Exhibit 36.—*Nov. 4th*, 1873.

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

Whereas letters patent of the United States were granted unto Nelson Goodyear, bearing date the 6th day of May, 1851, for an improvement in the manufacture of india-rubber and allied gums;

And whereas the said letters patent were surrendered on account of a defective and insufficient specification, by Henry B. Goodyear, as administrator of the said Nelson Goodyear, deceased, and thereupon two new letters patent were granted for different parts of the said invention, for the residue of the unexpired term for which the original letters patent were granted; one of the said new patents being for the new product, manufacture, or substance known as the hard compound of vulcanized caoutchouc or india-rubber, and allied gums; and the other for the improved process for producing the said product or substance, both of which said new letters patent bear date the 18th day of May, 1858;

And whereas the American Hard Rubber Company, of New York, are the owners by assignment of the right, under the before-recited letters patent, of working the said process, and producing, applying, and vending the said substance as applied to dental purposes;

And whereas A. W. Todd, of Montgomery, county of Mont-
504 gomery, and State of Alabama, is desirous of acquiring the right, privilege, or license of working the said process, and using the said substance for artificial gums or plates for artificial teeth, in his own business as a dentist, and to practice the same in the said city of Montgomery, and nowhere else:

Now this agreement, made the 18th day of April, A. D. 1860, between the said American Hard Rubber Company, of the first part, and the said A. W. Todd, of Montgomery, of the second part, witnesseth:

That the party of the first part, for and in consideration of the sum of one hundred dollars, paid to them by the party of the second part, the receipt of which is hereby acknowledged, and the faithful performance by the party of the second part of the conditions herein specified, doth hereby grant to the party of the second part a right, privilege, or license, under the two before named patents, to work the said process for the production of artificial gums or plates for artificial teeth, and for no other purpose, and to vend the gums and plates thus prepared, within the said city of Montgomery, and nowhere else, during the residue

of the time for which said letters patent were granted, upon the following conditions, and to cease and to become of no effect in the event of the failure to comply with any one or all of the conditions herein specified:

First. That the said right, privilege, or license, shall not be assigned, sold, or transferred, or otherwise disposed of in any manner, without the written consent of the American Hard Rubber Company.

Second. That the said A. W. Todd shall not permit any one in his employ, or under his control, to practice the said invention, or vend or otherwise dispose of the said substance, except for the business of the said A. W. Todd, and for the purposes and within the limits herein specified.

Third. That the said A. W. Todd by himself, or his agents or servants, shall not practice the said invention or vend or use the said substance, except in his own business and for his own office patients, and within the limits of the said city of Montgomery.

Fourth. That the said A. W. Todd shall at all times admit the validity of the said patents, and shall in no manner countenance or encourage infringements on the same.

Fifth. All improvements made by the said A. W. Todd, or by those employed by him, in the compounds or mixtures of gums used for
505 vulcanizing, or in the process or method of working or vulcanizing the same, shall be for the benefit of the said American Hard Rubber Company, and their licensees, as well as for that of the said A. W. Todd.

Sixth. That the party of the second part shall, on or before the 18th day of January, A. D. 1861, pay to the party of the first part a certain promissory note for seventy-five dollars, with interest until the same shall be paid.

Seventh. And the party of the second part, for and in consideration of the rights and privileges herein granted, hereby covenants and agrees to hold the within granted rights and privileges, subject to the terms and conditions herein specified, and that in case of failure on his part to comply with all or any of them, then this license shall ever after be null and void.

This license shall not be valid unless countersigned by Bradley W. Franklin, agent of the Patent Vulcanite Dental Agency.

In witness whereof, the parties to these presents have hereunto set their hands and seals the day and date above mentioned.

[SEAL.] AMERICAN HARD RUBBER CO.,
W. A. LACKEMANN,
Secretary.
BRADLEY W. FRANKLIN,
Agent.

Def't's Exhibit 37.—*Nov. 4th*, 1873.

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

Whereas letters patent of the United States were granted unto Nelson Goodyear, bearing date the 6th day of May, 1851, for an improvement in the manufacture of india-rubber and allied gums;

And whereas the said letters patent were surrendered on account of a defective and insufficient specification, by Henry B. Goodyear, as administrator of the said Nelson Goodyear, deceased, and thereupon two

new letters patent were granted for different parts of the said invention, for the residue of the unexpired term for which the original
506 letters patent were granted; one of the said new patents being for the new product, manufacture, or substance, known as the hard compound or vulcanized caoutchouc or india-rubber and allied gums; and the other, for the improved process for producing the said product or substance, both of which said new letters patent bear date the 18th day of May, 1858;

And whereas the American Hard Rubber Company are the owners by assignment of the right, under the before recited letters patent, of working the said process, and producing, applying, and vending the said substance, as applied to dental purposes;

And whereas S. S. Blodgett, of Ogdensburgh, county of St. Lawrence and State of New York, is desirous of acquiring the right, privilege, or license of working the said process, and using the said substance for artificial gums or plates for artificial teeth, in his own business as a dentist, and to practice the same in the said town of Ogdensburgh and nowhere else:

Now this indenture witnesseth, that for and in consideration of one dollar, lawful money of the United States, the receipt whereof is acknowledged, and the faithful performance by the said S. S. Blodgett of the conditions hereinafter specified, we have bargained, sold, and conveyed, and by these presents do bargain, sell, and convey unto the said S. S. Blodgett a right, privilege, or license, under the two before recited letters patent, to work the said process for the production of artificial gums or plates for artificial teeth, and for no other purpose, and to vend and use the same within the said town of Ogdensburgh, and nowhere else, during the residue of the term for which the said letters patent are granted; the said right or license being granted upon the following conditions, and to cease and to become of no force or effect in the event of the failure to comply with any one or all the conditions hereinafter specified:

First. That the said right, privilege, or license shall not be assigned, sold, or transferred, or otherwise disposed of, in any manner without the written consent of the American Hard Rubber Company.

Second. That the said S. S. Blodgett shall not permit any one in his employ or under his control to practice the said invention, or vend, or otherwise dispose of the said substance, except for the business of the said S. S. Blodgett, and for the purposes and within the limits herein specified.

Third. That the said S. S. Blodgett by himself or his agents or servants shall not practice the said invention, or vend or use the
507 said substance, except in his own business and for his own office patients, and within the limits of the said town of Ogdensburgh.

Fourth. That the said S. S. Blodgett shall at all times admit the validity of the said patents, and shall keep a true and faithful account of all and every gum-plate or other piece vulcanized by him, or for him, whether the same is made of India-rubber, gutta-percha, or other vulcanizable gum or gums, and used or sold by him in his said business, with the number of teeth contained in each piece thus vulcanized, and shall render quarterly, under oath, viz, on or before the 10th day of each of the months of January, April, July, and October of each and every year during the existence of the said patent, a true and faithful account thereof, which he shall transmit by mail to the said American Hard Rubber Company or their duly authorized agent at New York, and shall, on or before the

12th of each of the months in which the said accounts are rendered, forward by express to the said company, or their duly authorized agent, fifty cents for each piece containing one, two, or three teeth only, and one dollar on each piece containing any number of teeth over three, vulcanized by or for him, according to the account thus rendered.

Fifth. All improvements made by the said S. S. Blodgett in the compounds or mixtures of gum used for vulcanizing, or in the process or method of working or vulcanizing the same, shall be for the benefit of the said American Hard Rubber Company and their licensees, as well as for that of the said S. S. Blodgett.

Sixth. This license will not be valid unless countersigned by Bradley W. Franklin, agent.

In witness whereof the American Hard Rubber Company have caused their secretary to sign these presents and affix their seal thereto on Friday, this 22d day of April, A. D. 1859.

[SEAL.] AMERICAN HARD RUBBER COMPANY,
By JOHN W. LEAVITT, *Secretary.*
BRADLEY W. FRANKLIN, *Agent.*

508 Circuit court of the United States, district of Massachusetts. In equity.

THE GOODYEAR DENTAL VULCANITE COMpany et al.
vs.
DANIEL H. SMITH.

Evidence for defendant, taken in pursuance of the sixty-seventh rule of the Supreme Court of the United States, in equity, as amended, and conformably to notice hereto annexed, at No. 522 Walnut street, in the city of Philadelphia, on the 11th day of November, 1873, at 10 o'clock a. m., before Aubrey H. Smith, examiner.

Present, B. F. Lee, esq., for complainant, and Henry Baldwin, jr., for defendant.

Counsel for defendant produces a printed publication entitled Dental News Letter, vol. iv–v, the title-page of which is as follows: "The Dental News Letter, a quarterly publication, devoted to the interests of the dental profession. Volumes iv and v. Jones, White & McCurdy, publishers and proprietors, No. 116 Arch street, Philadelphia; No. 263 Broadway, New York; Tremont Row, Boston," and refers to No. 2, vol. iv, January, 1851, of said publication, pages 59, 60, 61, 62, and 63 of said No. 2, article entitled "On the use of tin as a base for artificial teeth, by George E. Hawes."

509 WILLIAM B. SELHEIMER being duly sworn.

Q. 1. State your residence, age, and occupation.

A. I reside at No. 318 Christian street, in the city of Philadelphia; I am fifty-one years of age, and a printer by occupation.

Q. 2. Look at the volume now shown you, "Dental News Letter, volumes iv and v," and at the part thereof entitled No. 2, vol. iv, Jan'y, 1851, and state if you know when that number of said volume was published.

A. I am satisfied that this was published about the last week of December, 1850, or in the beginning of January, 1851. The numbers were published quarterly in January, April, July, and October, and were always got out a few days in advance of those dates.

Q. 3. State your connection with said publication.

A. I was foreman of the printing office at the time when this book was printed, and I have been there ever since, and I am now the owner of the printing establishment.

Cross-examined by Mr. LEE:

X Q. 1. Can you state positively from your own recollection that the number of the Dental News Letter that you have referred to was actually published in January, 1851, or do you merely infer that it was published at that time from now seeing that date printed upon it?

A. I know from my own recollection that we were printing the Dental News Letter at that time, and it was published either in the month of January or in the December previous. I cannot give you the day, but the rule was to get it out previous to or about the first of the month of each quarter.

X Q. 2. Can you state positively of your own knowledge that the number of the Dental News Letter that you have just looked at, and which is referred to in this examination, is one of the identical copies which were printed by you, or the office with which you were connected, in December, 1850, or January, 1851?

A. Yes, sir; I can state that positively.

X Q. 3. Please state your reasons for being so positive.

A. I know the printing.

X Q. 4. Can you state positively of your own knowledge that the article printed in the Dental News Letter, which you now hold in your hand, on pages 59, 60, 61, 62, and 63, entitled "On the use of tin as a base for artificial teeth, by George E. Hawes," was contained in the num-
510 ber of the Dental News Letter printed by you in December, 1850, or January, 1851, and published in one of those two months, and that the same has not been altered or changed since that time?

(Objected to by Mr. Baldwin as incompetent.)

A. I have examined, and I am satisfied that the pages referred to are a portion of the number of the Dental News Letter printed at that time, and I cannot observe any changes or alterations in it since then. I am as positive of this as a man can be of anything.

WILLIAM B. SELHEIMER.

Sworn and subscribed before me this 11th day of November, 1873.

AUBREY H. SMITH.
Examiner.

PRESLEY BLAKISTON being duly affirmed.

Q. 1. State your age, residence, and occupation.

A. I am sixty years of age; I reside at No. 2042 Chestnut street, Philadelphia, and I am in business as a book publisher in this city.

Q. 2. Look at the printed volume now shown you, being "the American Journal of Dental Science, new series, volume i; Philadelphia, Lindsay & Blakiston; Baltimore, Armstrong & Berry; New Orleans, John Ball, 1850," and state if you know when that part of said volume comprising from pages 3 to 108, both inclusive, was published.

A. We were not the absolute publishers at that time, but only the nominal publishers for Dr. Harris. I know that the number was published during the month of October, 1850. I know this of my own recollection. It was printed in Baltimore.

(Defendant refers to the pages of said volume 3 to 12, article 1, on the use of tin as a base for artificial teeth, and article 2, experiments in the use of tin for insertion of teeth, which articles are put in evidence and

marked by the examiner Defendant's Exhibit No. 38, and Defendant's Exhibit No. 39.)

Cross examined by Mr. LEE:

X Q. 1. Can you state of your own knowledge that the articles Exhibits Nos. 38 and 39 were published in the month of October, 1850, and that the same have not been in any way changed or altered since that time?

511 (The latter part of the question objected to by Mr. Baldwin.)

A. I have no familiarity with the articles or their nature, but from my general knowledge of the book and the circumstances connected with its publication, I should say positively there has been no change in it since its publication. I should say positively that these articles were published in October, 1850.

X Q. 2. State fully your means of knowledge as to the matters contained in the last question and answer?

A. We were in constant communication with the principal editor, Dr. Harris. We were the publishers for him in Philadelphia. We received and sold the journal, and took subscribers for it as his agent, and I know from the mechanical execution and appearance of the book, that it could not have been otherwise than I have stated.

X Q. 3. When did you receive the number of the journal containing the articles Exhibits Nos. 38 and 39?

A. During the month of October, 1850. I cannot give the exact date. They were forwarded to us by Mr. Woods, the printer, from Baltimore.

PRESLEY BLAKISTON.

Affirmed and subscribed November 11th, 1873, before me.

AUBREY H. SMITH,
Examiner

Defendant offers and puts in evidence the article referred to in the deposition of William B. Selheimer, pages 59 to 63, of the Dental New Letter, and the same is marked by the examiner, Defendant's Exhibit No. 40.

Defendant further produces a printed volume of The Lancet, "a journal of British and Foreign Medical and Chemical Science, Criticism, Literature, and News, 1845," and puts in evidence the article on pages 284 to 287, in the number for September 13th, 1845, and pages 310, 11, and 12, of the number for September 20th, 1845, of said volume; and the same is marked Defendant's Exhibit No. 41.

Also the American Journal of Dental Science, volume IV., New Series, and refers to pages 79 to 93, to page 176, and to pages 223 to 226, being in the numbers of said volume for October, 1853, and for January, 1854. The said articles being collectively marked Defendant's Exhibit No. 42.

512 Also the American Journal of Dental Science, volume VI., New Series, and refers to pages 477, 478, and 479, in the number of said journal for July, 1856, which article is marked Defendant's Exhibit No. 43.

Also the Dental News Letter, volume XI., April, 1858, No. 3, and refers to pages 170, 171, and 172, of said volume. Also refers to pages 253, 254, and 255, in the number of said volume for July, 1858, and to the second page of advertisements at the back of said number of said volume; and the same are collectively marked Defendant's Exhibit No. 44.

Also the Dental News Letter for July, 1859, being No. 4, of volume XII, and refers to pages 289 and 290 of said volume; and the same is marked Defendant's Exhibit No. 45.

Also the Vulcanite, volumes I. and II., and refers to the following pages of volume I., namely, No. 1, May, 1860, pages 2 to 14, both inclusive; No. 2, August, 1860, pages 68, 69, and 70; No. 3, November, 1860, pages 99 to 105, and pages 130 to 132, of said number. Also in No. 4 of said volume, February, 1861, pages 178 to 180, and in volume II., No. 1, May, 1861, pages 40, 41, and 42; No. 3, November, 1861, page 142; and the same are collectively marked Defendant's Exhibit No. 46.

Also a volume entitled The Principles and Practice of Dental Surgery. By Chapin A. Harris, M. D., etc., Philadelphia, 1853. And refers to pages 736, 737, 738, 739, and 740; and the same is marked Defendant's Exhibit No. 47.

Also, a Dictionary of Medical Terminology, Dental Surgery, and the Collateral Sciences. By Chapin A. Harris, M.D., etc. Second Edition, 1855. Pages 343 and 344; title, Gutta-Percha; and the same is marked Defendant's Exhibit No. 48.

Also a volume entitled Great Exhibition of the Works of Industry of all Nations, 1851. Official Descriptive and Illustrated Catalogue. And refers to page 474, article 720; and the same is marked Defendant's Exhibit No. 49.

Also a volume entitled The Works of Industry of all Nations, 1851. Reports of the Juries, etc. London, 1852, vol. 1., and refers to page 598, article beginning "quite recently by the exertions of Mr. Truman," and ending with the words, "very well adapted to this use," which is marked Defendant's Exhibit No. 50.

Also volume II, New Series, American Journal of Dental Science.
513 And refers to pages 332 and 333 in the number of said journal for January, 1852; and the same is marked Defendant's Exhibit No. 51.

Also, Comtes Rendus Hebdomadaires des Séances de l' Académie des Sciences. Vol. XXXIII., July to December, 1851. Paris, 1851. And refers to page 126 of said volume; and defendant appends thereto a translation of said article, the two together being marked Defendant's Exhibit No. 52.

Also, a volume in French entitled, Revue Odontotechnique Franco-Americaine. And refers to pages 160, 161, and 162, being of No. 6, June, 1860, of said volume, and defendant appends thereto a translation of said article; the two together being marked Defendant's Exhibit No. 53.

Also, refers to pages 297, 298, 299, and 300 in No. 11, November, 1860, of said volume. And appends thereto a translation of said article; the two together being marked Defendant's Exhibit No. 54.

Also, the New York Dental Recorder. Vol. IV., 1850. And refers to pages 286, 287, 288, in the number of said journal for September, 1850; and the same is marked Defendant's Exhibit No. 55.

Also, the Dental Register of the West. For October, 1850. And refers to pages 38, 39, and 40 thereof; and the same is marked Defendant's Exhibit No. 56.

Complainants admit that the publications above referred to, as marked Defendant's Exhibits 41 to 56, both inclusive (excepting only the translations appended to Exhibits 52, 53, and 54, as above noted,) are the printed publications correspondingly, but more formally, specified in defendant's answer.

And further admit that the said publications were published as re-

cited in said answer, except as to Exhibits Nos. 55 and 56, and as to said two Exhibits they admit they were published in the year 1850.

Dr. ELIAS WILDMAN being duly sworn.

Q. 1. State your age, residence, and occupation.

A. I am in my sixty-third year; I reside at No. 1205 Arch St., Philadelphia; and I am a dentist and professor in the Pennsylvania College of Dental Surgery of Philadelphia. I have been practicing dentistry since the spring of 1836. And I have been a professor, as I have stated, since the summer of 1862.

514 Q. 2. In the course of your practice, have you used, in connection with gold or silver bases for artificial teeth, tin as a part of such base? And if yea, when first, and during what period of time?

A. I can answer that I have used tin as a part of the base. The first time I recollect using it was in 1851. In that year I inserted some six or eight cases at least, and I have no doubt many more.

Q. 3. When and from whom did you first hear the suggestion of the use of tin as a base for artificial teeth?

(Objected to, as incompetent.)

A. My first recollection of hearing of it was in 1848, from Dr. Crosby, of New Haven, Connecticut.

Q. 4. What was Dr. Crosby's name or initials?

A. It was C. O. Crosby; known as Dr. Crosby, of New Haven.

Q. 5. Look at the publication now shown you, marked Defendant's Exhibit No. 38, being pages from 3 to 8 of the American Journal of Dental Science, Volume I., No. 1, New Series, 1850, and state whether or not you have see that article before; and if yea, when first, as well as you can recollect.

A. I have seen this article before. I was a subscriber to the journal, and I consequently received it immediately after its publication. I can't fix the exact date.

Q. 6. State whether or not you read that article before you commenced the use of tin in 1851.

A. I did.

Q. 7. Please state how far your practice in the use of tin conformed to that article or to any part thereof, and to what part.

A. My practice was in general conformity with the instructions here given, with the exception in striking a gold or silver plate using that as a base plate, instead of rubbing down a thin tin plate to fit the model, and having this covered with a plate of wax.

Q. 8. Please describe your practice referred to, giving each step in the order followed by you.

A. The first step is to take an impression of the mouth or gums with wax; the next step is to make a model of the mouth from this impression, by pouring into the impression plaister of Paris properly mixed, or plaister and sand; the next step is to remove the wax from the model. From this model we make a mould in sand, into which is cast a hard metal, zinc; this is the die, formed; it is a counterpart of the plaister model, or a fac simile. We next make a counter-die in lead, fitting the face of the die. The next step in the operation is to stamp up the silver or gold plate be-

515 tween the die and counter-die, so that it shall fit the face of the die accurately; consequently, it will fit the plaister model, also the gums from which the impression was taken. We now place a rim of wax upon this metal plate. We next place this metal plate in the mouth, with a rim of wax upon it, and trim it so as to get the proper

length that the teeth should be, also the contour, so as to give the patient a natural expression. The plate is now removed from the mouth, and an articulating model made by laying the model face upwards, plate upon it, and articulating wax on the plate, then joining plaister to the heel of the model extending back about two inches, having the thickness of the model.

After the plaister has become hardened, the surface smoothed, indentations are cut in the face, for the purpose of having corresponding projections in the opposite part of the articulating model. The surface is then oiled, and plaister poured over the surface, covering the part referred to at the heel of the die, and extending to the extent of the contour of the articulating wax. After this plaister is hardened, the two sections of the articulating model are separated, the articulating wax removed from the plate, then a rim of soft wax is placed on the plate to retain the teeth as they are fitted down according to the articulating model. After they are fitted down, the wax is smoothed and built around the back of the teeth, so as to cover the platina pins in the teeth, so as to give it the proper shape it is desired to have when finished. Also the fronts of the teeth at their base are modelled around with wax, where the case is such that the base of the tooth or block did not fit the metal plate accurately. The plate, with the teeth adjusted according to the articulating model, are now placed in the mouth, to ascertain if the articulation is perfectly correct; if found correct, the next process is to make a mould in which to cast the tin. If the model was made of plaister and sand, it was used in making the mould. If made of plaister alone, it was not used, and we proceeded as follows: We first make a rim of suitable size for the circumference of the mould, and about an inch and a half high; this was nearly filled with a mixture of plaister and sand, the palatal surface of the plate on which the teeth are adjusted at the same time filled with this mixture of plaister and sand; this is immediately pressed down in this plaister in the rim, so that the two shall unite in hardening, and to the depth nearly up to the porcelain teeth. After this is hardened, the surface is oiled, a rim placed around it, and a mixture of plaister and sand poured in,
516 covering the teeth and plate to the depth of about an inch and a half. After this mixture of plaister and sand has become hard, this mould is heated so as to soften the wax; the parts are then separated, the wax is entirely removed from around the teeth and the plate, leaving the teeth firmly imbedded in the upper section of the mould and the plate in the lower section. An orifice is now cut in one section of the mould, leading from some part of the mould occupied by the wax to the surface of the mould; this is the gate through which the melted tin is poured. Also two small openings from the central portions of the mould to the surface, to allow a free egress of the air as the melted tin is poured into the mould. The mould is now dried, heated up to near the melting-point of tin, the two sections of the mould are secured together firmly, and melted tin poured into the gate until the mould is full. After the mould has cooled, it is separated from the plate and teeth; the case is then ready to be finished. One omission I made, before closing the mould for casting, I omitted to state that to give a better union between the pins and the plate and the tin, those surfaces were generally covered with a solution of chloride of zinc. I mean the surfaces of the platina pins, and of the silver or gold plate, is covered with chloride of zinc wherever the tin would come in contact with them.

Q. 9. Please state where this practice was pursued by you, as stated, in the year 1851.

A. In the city of Philadelphia.

Q. 10. Can you produce a plate made by this process? If yea, please do so, and have it marked as an exhibit, and state when it was made, and whether it has been in use or not.

A. This plate I now produce was made by the process I have described. It was made in April, 1851, and was worn upwards of five years. It has been repaired, by having part of the front block renewed; this plate was made by me.

(This plate is offered in evidence, and marked E. W., No. 13.)

Q. 11. Please produce, to be marked as exhibits, models representing the condition and form of the materials used in the process you have described, other than the zinc die, and lead counter die.

A. I here produce model marked E. W., No. 1, which is an impression of the mouth in wax. Also, model of the mouth, marked E. W., 1 A. I have not the next stage, which is a zinc die made from 1 A by means of a sand mould as I have previously described. I have not the
517 counter-die of lead I have previously described; the wax plate marked E. W. 3, represents the silver plate struck up between those two dies; E W. 4 represents the same plate with the rim of wax upon it to get the articulation; the next is the articulating model, marked E. W. No. 5, representing in this instance an entire set, upper and lower. Exhibit E. W. 16 represents the teeth arranged according to the articulating model. Exhibits E. W. 12 and 12 A. represent the mould made according to the description just given, with the teeth imbedded in the upper section; plate in the lower section; gate cut, air-vents made, ready for filling with tin. These models, with the explanations given in my previous answer, complete the illustration of the process.

The examination is by consent here adjourned until to-morrow, Nov. 12th, at 10 o'clock a. m.

NOVEMBER 12TH, 1873.

Counsel of parties attending as before; the examination of Dr. Wildman is continued, as follows:

Q. 12. Please produce, to be marked as exhibits, models illustrating the process of forming an underset of pure tin, as described in the article Defendant's Exhibit 38.

A. I produce the wax impression for the underset, marked E. W., underset 1, and the plaster model made from the wax impression, marked E. W., underset 2; this has been made without any sand in the plaster; next is the wax plate fitting the model with the tin lining underneath, which plate is marked with the figure 3.

The next is the wax on the plate, trimmed to the proper curve and height, as in the ordinary practice at that time, which is marked with the figure 4; the next I produce the teeth on wax plate as represented in figure 1 of Exhibit 38, which is marked with the figure 6; the next I produce the wax plate with the teeth mounted in wax and carved to represent the natural gums and supply the required fullness, the tin foil remaining under the wax,—the whole thing representing figure 2 of Exhibit 38, which plate is marked with the figure 7; next are the moulds composed of plaister and sand, ready for pouring in the melted tin, as represented in figures 3 and 4 of Exhibit 38, and these models are marked with the figure 8.

518 Q. 13. Between the stage represented by the piece marked with the figure 4, and the piece marked with the figure 6, state and illustrate by model any intermediate step in the ordinary practice at that time.

A. The intermediate step was to make an articulating model in plaister, which is represented by the plaister model I now produce, marked figure 5, which is an articulating model for the entire double set. In this model, the teeth were arranged as represented in pieces marked with the figures 6 and 7.

Q. 14. Please produce, to be marked as exhibit, an underset of tin, made by the process you have described in moulds such as that marked with the figure 8.

A. I produce piece which is marked with the figure 11.

Q. 15. Please produce, to be marked as an exhibit, an upper set of poured metal, and state how far the mode by which that was made agrees with, or differs from, that you have just described for making the lower set.

A. I now produce a plate marked with the figure 15, which was cast in a mould, of which the mould marked with the figure 9 is a perfect representation, and made precisely in the same manner that I have described for making a mould in which to cast the underset marked with the figure 11.

Q. 16. State whether in making such set, whether upper or under, the mould is necessarily destroyed after the pouring is done; and if yea, why.

A. It is necessary to break the mould in nearly every case, to free the plaister and sand from the teeth and gates projecting from the piece when first cast.

Q. 17. Please state what Exhibit 15, above referred to, is made of.

A. It is made of a composition called "Weston's metal," which is composed principally of tin; what the other ingredients are I don't know.

Q. 18. Please state if you have made dental plates of hard rubber or vulcanite; and if yea, when first, and during what period of time.

A. I have made such plates; I first made them in 1860, and have been making them, more or less, ever since.

Q. 19. State if you had a license at any time from the American Hard Rubber Co. to work the Nelson Goodyear process for the produc-
519 tion of artificial gums or plates of artificial teeth, and to vend the gums and plates thus prepared within the city of Philadelphia; and if yea, produce the same to be marked as an exhibit.

A. I had such a license presented to me by the American Hard Rubber Co. in June, 1864, which I now produce, and the same is marked Exhibit Wildman's License.

Q. 20. Please state whether in making plates of hard rubber, or vulcanite, you first formed a mould; and if yea, how such mould was formed.

A. The impression of the mouth was taken, the model made, the articulation procured, the articulating models made, the teeth arranged, and moulds or flasks made, like those produced in connection with the exhibit marked with the figure 15, and as described in the Exhibit 38 for an under set, with this exception, that the moulds or flasks were made of plaister instead of plaister and sand.

Q. 21. State whether or not, in the manufacture of the rubber plates, it is the practice to try the wax model in the mouth before making a cast of it for the mould, so as to adjust the wax model to the expression

of the patient, or to the contour of his jaw, so as to have it exactly right in these respects.

A. In my practice, I place the model wax set in the mouth, to test the correctness of the articulation before making a mould from it. I may add that this is the practice of all careful workers, but it is not the universal practice.

Q. 22. State whether or not, in making a vulcanite plate, it is essential that gates or passages should be made in mould; and if yea, why?

A. I look upon it as essential to have gates or passages cut leading from the body of the mould to the surface, to allow the escape of any surplus rubber that might be placed in the mould, for without this precaution the sections of the flask could not be brought together should there be any excess of rubber in the mould. We always put a little excess in to insure the mould being full.

Q. 23. When the sections of the flask are brought together, what becomes of the excess of rubber?

A. If the excess is small, it merely flows into the grooves or gates, and remains there. If large it will pass out through these grooves to the edge of the mould.

Q. 24. State whether or not it is essential that the rubber in the mould should be subjected to pressure; and if yea, why?

A. After the unvulcanized rubber is packed in the mould, it is
520 necessary to subject the sections of the mould or flask to pressure, to bring them together; this causes the rubber to flow around the exposed parts of the teeth and fill the mould, fitting it accurately.

Q. 25. If the rubber is put in the mould without any excess, what, in your experience, is the consequence?

A. I have no experience in that. I always use a slight excess, for the reason that it is very difficult to calculate the exact quantity that would fill the mould; and should there be a slight deficiency, the mould would not be properly filled, and the case would be spoiled. On the other hand, a slight excess is easily got rid of by means of the gates or grooves.

Q. 26. Please produce, to be marked as an exhibit, a plate of hard rubber, showing how the excess is got rid of by means of the gates or grooves.

A. I produce a plate marked with the figure 18. This illustrates one method of making the gates or grooves—they are generally made on the proximal faces of the mould; in which case the projections filling the gates or grooves appear on the edges of the unfinished set instead of on top, as in figure 13.

Q. 27. State whether the rubber plate, Exhibit 18, was made in a mould such as you have already produced; and if yea, how is such mould numbered?

A. The piece marked with the figure 18 was made in a mould, packed, brought together and vulcanized, of which No. 9 is a true representation, and piece numbered 18 A is the lower section of the mould in which this piece was vulcanized; the upper section was necessarily broken, to free it from the teeth and plate.

Cross-examined by complainant's counsel:

X Q. 1. When you manufactured plates by pouring tin upon bases of sheet metal, was it not necessary to work the sheet-metal base to fit the mouth, just the same as if the teeth were to be riveted fast in the usual or old-fashioned way?

A. Yes; metal base plate was made precisely in the same way as if the teeth or blocks were to be riveted or soldered on.

X Q. 2. Did you manufacture any plates of pure tin before 1853, or at any other time, by casting tin into moulds in which teeth were first fixed for the purpose of being secured to the plate?

A. I cannot say positively that I did, but I am under the impression that I made such plates.

521 X Q. 3. When is it your impression that you made such plates?

A. It was about the year 1850.

X Q. 4. For whom did you make any such plate, and did it go into use?

A. That is a question I can't answer, because I have just stated I am not positive that I made any.

X Q. 5. Was not the metal out of which you made the plate, Exhibit 15, known as a patented alloy?

A. It is not patented, but a secret compound. I think it is not patented; the inventor does not make it known.

X Q. 6. How did you discover that it was principally tin?

A. By the character of the metal, and the close alliances and properties of alloys that are composed almost wholly of tin.

X Q. 7. Explain to the court the tests you have applied to this metal, by which you have ascertained that it was composed almost entirely of tin.

A. I have applied no chemical tests, merely judging by the general properties of the alloy.

X Q. 8. Explain the mode of your examination, and specify each of the properties this alloy possesses by which you know it is composed of tin principally.

A. I judge by its lustre, the condition of hardness, and the action of the secretions of the mouth upon it.

X Q. 9. What comparison did you make between it and a known tin plate, by which you ascertained that the secretions of the mouth affected both alike; and when was that trial made, and in whose mouth?

A. I cannot specify the persons by name where I examined particularly the condition of Weston's metal plate, after having been worn some months; the person was a patient in the college clinic; the names I never get. I did not say that the secretions affected both alike. I said tin alloys. I compared the Weston metal with tin alloys.

X Q. 10. State what plate of tin alloy and the composition of that tin alloy you used when you made the comparison by which you ascertained that No. 15 was composed almost entirely of tin.

A. The composition of those alloys vary so materially that it should be more properly the properties of alloys. By a slight modifica-

522 tion of the proportion of the ingredients the properties of alloy is generally materially changed. The alloy that I call to mind at present is known as Brown's metal, which is composed almost wholly of tin.

X Q. 11. What are the ingredients of Brown's metal, and in what proportions, and how do you know the proportions and ingredients?

A. I cannot call to mind the exact proportions. The formula for making it is not made public; but Dr. Brown, in placing specimens in my hands of this alloy, told me the proportions of the different metals entering into this composition. To the best of my recollection it contains about 96 per cent. of pure tin; they put in a little bismuth or a little antimony, and the least fraction materially changes the character of the metal.

X Q. 12. Now suppose Dr. Brown communicated this secret to you, what experiment did you try with his compound, and with the Weston compound, by which you ascertained that the Weston compound was almost entirely of tin? State the particulars of that experiment, and the results that led to the conclusion, so that the experiment may be tried over again if necessary.

A. I don't recollect going into any series of experiments that I can relate at present by which I arrived at that conclusion.

X Q. 13. If you tried no experiments in comparison with the Brown compound, with what other alloy of tin did you compare Exhibit 15, in order to ascertain that it was composed principally of tin; and if you did experiment with another alloy, what was it, and when was the experiment tried?

A. I did not say that I tried no experiments with the Brown metal. I believe I did try some, but I cannot call to mind the exact method in which they were conducted to arrive at this conclusion.

X Q. 14. Did you experiment with any other alloy; if so, what other, for the purpose of ascertaining that Exhibit 15 was composed almost entirely of tin?

A. I don't recollect now that I experimented for that special purpose with any other alloy.

X Q. 15. If you don't remember the particulars of the experiment you tried with the Brown compound for the purpose of ascertaining that Exhibit 15 is composed almost entirely of tin, can't you remember about the time and the place where you tried the experiment?

A. The experiments, I presume, were performed in my labora-
523 tory, I presume at least four or five years since; not deeming the metals of much value, I did not particularly burden my mind with the operation.

X Q. 16. If you forget how you tried the experiments by which you came to the conclusion that the Weston metal was composed almost entirely of tin, will you be good enough to tell us how the experiment ought to be tried now in order to ascertain correctly that fact, so that the experiment may now be tried over?

A. I presume the most certain method would be to make a chemical analysis of the plate or metal, which would give the exact proportion of each of the metals entering its composition.

X Q. 17. Was that what you did?

A. I have already answered that I did not go into any chemical analysis of it.

X Q. 18. Then did the experiment you tried in your laboratory four or five years ago, so far as you now remember, consist in looking at the metals, and drawing your conclusions from their color? If not, what more did you then do?

A. I have already stated that I do not recollect all the tests that I applied; therefore I cannot answer the question fully as to what else I did.

X Q. 19. Besides chemical tests, what others would you now suggest for ascertaining whether Exhibit 15 is composed almost entirely of tin?

A. I should judge by its lustre, hardness, and flexibility.

X Q. 20. Is not Exhibit 15 very much harder and very much more inflexible than pure tin?

A. It is somewhat harder and much more inflexible than pure tin.

X Q. 21. Is Exhibit 11 pure tin?

A. It is commercially pure tin.

X Q. 22. Is that, in your opinion, a practically useful material for making dental plates?

A. A good practical, useful under set can be made of tin, although I do not approve of the use of base metals as bases for artificial teeth.

(Question repeated, and witness is requested to answer yes or no.)

A. I should have to say yes to this; that it has been used practically.

X Q. 23. Did you ever use it?

524 A. That is, tin alone; I cannot say positively that I have. I am under the impression that I made one or two cases of pure tin in about the year 1850.

X Q. 24. What was the result of those one or two cases, and for whom did you make them?

A. I did not say that I made any, but that I was under the impression I had made one or two cases; and consequently, not having a distinct recollection of having made any, I cannot say what the result was, if I did.

X Q. 25. Have you no impression about the effect produced in the one or two cases, supposing you made them?

A. My impression is, if I ever made that work, the result was not satisfactory.

X Q. 26. Have you any personal knowledge of any other set of teeth mounted on pure tin having been made and used? If so, when and where, and by whom?

A. I cannot call to mind at present any particular case made wholly of tin as a base coming under my own immediate observation.

X Q. 27. Well, then, having the impression that the only time you ever tried it, if you ever did, resulted unsatisfactorily, and having no personal knowledge of any satisfactory result, will you be good enough to tell the court upon what fact you found your opinion that pure tin is a practically useful base for artificial teeth?

A. I said for under sets. I judge by the facility with which it can be adapted to the mouth, and its resistance to the secretions of the mouth. It may be useful in many cases where a cheap base is desirable.

X Q. 28. Have you no other fact to give in support of your opinion?

A. The fact is, that it is readily adapted by being poured in a mould, which in one part represents the gums; and tin is known by dentists to resist the secretions of the mouth even better than silver. Its weight may also be adduced as an advantage in some under cases.

X Q. 29. Did not you know all these facts in 1850 as well as you do now?

A. I was conversant with these facts at that time.

X Q. 30. Since that time have you not manufactured many hundreds of plates in which cheapness was very desirable, and have you not used silver on account of its cheapness, in a great number of cases?

525 A. I have used silver, and generally do for what we call temporary cases, because it is cheaper than gold; but I avoid the use of silver generally in permanent cases.

(Question repeated.)

A. I don't think I have.

X Q. 31. Is not cheapness a desirable quality in the manufacture of dental plates?

A. It is a desirable quality.

X Q. 32. Would it not be generally desirable to have something cheaper than gold in your practice?

A. Yes.

X Q. 33. Have you not often used silver instead of gold, because of its cheapness, for permanent sets of teeth?

A. I have in many cases used the silver base where the patient was not willing to pay for gold.

X Q. 34. Would it not have been desirable in those cases to have had something equally good, the material of which would have cost less, and the manufacture would have been cheaper than silver?

A. Yes.

X Q. 35. Would not pure tin have been cheaper to make, and cheaper for the raw material, than the silver plates you did make?

A. There would be very little difference between the two in the cost of workmanship; the material of tin would cost less than silver.

X Q. 36. Do you mean to tell the court that there is no material difference in expense for labor, whether you make moulds and dies, and with those dies strike up a silver plate, and then make other moulds for pouring tin upon that plate, or whether you cast the plate entire of tin at one operation?

A. My answer to the previous question had no reference to a silver plate struck up between a die and counter-die, and then a mould made so as to attach teeth to this plate by the means of tin cast in the mould, but referred to ordinary silver-plate work and plates made wholly of tin.

X Q. 37. Did you generally make your silver plate by casting tin on it, or did you generally make it without that process, since 1850?

A. I generally made it without that process since 1850; that was my general practice.

X Q. 38. Did you not generally make them in the way that you thought on the whole was the most advantageous?

526 A. Yes; I always made them in the way that I considered to the best advantage to my patient, and to give the most satisfactory result in wearing.

X Q. 39. Do you mean to say that with some patients it would be better to load the tin on a silver plate by the use of a mould for casting it in, whereas with other patients it would be better to apply the tin to the plate by the soldering-iron or otherwise?

(Objected to, the witness not having stated that he applied the tin to the plate by the soldering-iron in any case.)

A. I made no reference in any case in my answers to the use of soldering-iron; but in answer to this question, I say it would make no difference whether the tin was cast on the plate or run on by the soldering-iron.

X Q. 40. Is it not cheaper to cast a tin plate than to strike up a silver one and attach the teeth to it by any of the means that you practiced?

A. I think it is; that is, taking into consideration the expense of the silver plate.

X Q. 41. Is not the labor expense less, independent of the cost of material?

A. I cannot say positively, but I think it is.

X Q. 42. Well, then, the expense being less both in material and labor, and tin resisting the acids of the mouth better than silver, why did not you use it instead of silver for the purpose of making artificial teeth, if you believed it to be a practically useful material for that purpose?

A. I stated that I believed it could be made practically useful in some cases for under sets; but my reasons for not adopting it in general practice were, tin being a soft metal, easily bent, to give it rigidity to resist

the forces brought on it in mastication, the piece has to be made so thick that in upper cases it is objectionable on account of the bulk and on account of its weight; and if made thin enough to remove this disadvantage, the plate has not sufficient rigidity to prevent it from becoming distorted in masticating.

X Q. 43. Why did you not use it for under sets, it being cheaper to make, cheaper in itself, and capable of resisting the acids of the mouth better than silver?

A. The answer to the previous question 42 will apply to this in general, although there may be some cases in which the weight of the under set may be an advantage.

527 X Q. 44. Then do I understand you that it was not, in your opinion, a practically useful thing? Is that your opinion?

(Objected to, the witness having stated that it was practically useful in some cases.)

A. No, I do not say that, for there are many cases where it could be used to advantage for a cheap base.

X Q. 45. Did you in your experience ever meet with such a case?

A. I have seen cases of that character with similar work in the mouth.

X. Q. 46. Why did you not use this tin base in those cases where it would have been useful?

A. The case that I refer to particularly now was not my patient.

X Q. 47. Did you never in your long experience see more than one case where this tin base would have been useful?

A. I have seen several cases where it could have been applied to advantage or proved serviceable.

X Q. 48. Why did you not apply it to just one of those cases if it was a useful invention in your opinion?

A. In several cases I applied the same principle, and may have used it. I have no recollection, as I said before, of the cases.

X Q. 49. What do you mean by saying that you applied the same principle? Describe what you did.

A. The same principle was to strike up a silver plate and secure the teeth to it by casting a body of tin upon it.

X Q. 50. Why did you go to the expense for material and labor to make the silver plate and load it with tin, when a pure tin plate resists the acids of the mouth better than silver, and costs less both in material and labor to make it?

A. The extra amount of labor and expense was too small to be taken into consideration; the object of stamping the silver plate as a base on which to run the tin, to have a perfectly smooth surface in contact with the gum without dressing it down after it is adapted.

X Q. 51. Could not the tin plate be made as smooth as the silver one, or was that the difficulty that led you to the more expensive method?

A. No, that was not the difficulty altogether; tin can be cast comparatively smooth, although not perfectly smooth. I presume my prin-

528 cipal reasons for using a silver base plate, besides those already given, were that previous to my experimenting with the use of tin in the mouth we always struck up our plates between die and counter die, and when the tin base was so much talked about among dentists, and written about in the journals, I adhered to the old hard metal plate, and used the tin as a bond of union between the teeth, or blocks and plate.

X Q. 52. Do you know of no reason except the one you have given why you did not use this cheap and superior material for lower dental

plates, after having an impression in your mind that as early as 1850 you did use it twice without favorable results?

(Objected to as assuming that the witness has designated tin as a superior material.

Counsel for complainant explains that he uses the word "superior" to signify what the witness has testified, that tin is cheaper to buy, cheaper to work, and resists the acids of the mouth better than silver.)

A. I don't know that I have any further reasons to offer further than I have given in my answers to the previous questions.

X Q. 53. Does tin cast upon teeth adhere to them when it cools?

A. If you cast a piece of tin upon the plain or flat surface of the tooth, there would be no adhesion between the metal and the tooth. If you cast it around the tooth, so that it braces the tooth where it is smaller than the part of the tooth within the body of the metal, the tin by its contraction in cooling will hold the tooth firmly.

X Q. 54. Will the tin in cooling contract closer to the tooth or away from it?

A. That may depend on circumstances. Where the teeth are touched by a small mass of tin in comparison to the bulk of the tin, and the mould and teeth heated up nearly or quite to the melting point of tin, so that the whole mass will cool down uniformly, in that case the tin may be drawn a little away from the teeth; but if the metal is poured at a temperature just above its melting point, and the teeth are at a temperature a little below, in that case the metal would chill immediately around the teeth, and not be liable to contract away from them, the principal contraction taking place in the body of the metal remaining fluid longest.

Adjourned until Thursday, Nov. 13th, at 10 a. m.

529 Met pursuant to adjournment, and the cross-examination of Dr. Wildman is resumed.

X Q. 55. When and how did you discover that if the mould and teeth were heated up nearly or quite to the melting point of tin, so that the whole mass will cool down uniformly, in that case the tin might be drawn a little away from the teeth?

A. I don't consider that I made any discovery of the fact, as it is a law governing all metals that contract in cooling, and has been long known to all metal-workers. I consider this contraction so small as to be no practical disadvantage.

X Q. 56. When did you discover that if the metal is poured at a temperature just above its melting point, and the teeth at a temperature a little below, in that case the metal would not be liable to contract away from the teeth?

A. I don't consider I made any discovery of that kind at all; it is a general law governing all metals that contract, which I explained in the previous answer.

X Q. 57. How much below the temperature of melting tin must be the temperature of the teeth, according to the general law as you understand it, in order that there may be no shrinkage away from the teeth?

A. The temperature of the teeth must be sufficiently below to chill the metal immediately around the teeth before the body of the mass of the metal becomes solid.

X Q. 58. How much, in degrees, below the melting point of tin would be sufficient, as you understand the general law?

A. That will depend altogether upon the temperature at which the tin is poured, in a great measure at least.

X Q. 59. What experiments have you tried from which you have ascertained that under some conditions a melted tin base will shrink away from the teeth, and under other conditions it will not? State the experiments particularly, when you tried them, and what were the results of each.

A. I have performed no special experiments to illustrate this subject, but have given my answers from the general laws governing the contraction of metals.

X Q. 60. Can you refer the court to any authority in which what you call the general law, namely, that when the temperature of the teeth and the tin is the same, the metal will shrink away from the teeth,
530 but when the temperature of the teeth is a little lower than that of the tin, the metal will not shrink away from the teeth, is to be found?

A. I don't know that I can to any that applies specially to this subject. In any standard work on metallurgy or chemistry you will find the general laws governing metals.

X Q. 61. Can you find in any such book among those general laws such a law as you have defined in this case, applicable to this or any analogous subject? If so, please refer to any book, out of the gre t number comprehended in your answer, in which any such law is to be found.

A. I can't say positively that I can point, but I believe that you can find it in Byrne's Metal-Worker's Assistant.

X Q. 62. Was Exhibit No. 11 under set made by you as well as you know how to make it?

A. It was made by me; but by taking extra pains I could get a better finish.

X Q. 63. Is the union between the metal and the teeth as perfect as you could make it in the act of casting?

A. I think it is.

X Q. 64. Do you think it a good piece of work when a quill toothpick can be passed down between the metal and the teeth?

A. I do not.

X Q. 65. Look at the exhibit with the toothpick inserted between the teeth and the metal, and say whether it is not evident that the metal shrank away from the tooth at the place where the toothpick can be passed down.

A. In my previous answer I had not observed this little defect. It has evidently been caused by the metal not filling the mould perfect at this point, or has been pried off with a toothpick and not caused by shrinkage.

X Q. 66. Do you think that it is a good set of teeth for practical use when the teeth are loose in the plate, after they have been set into it, and before they have been subjected to use in the mouth?

A. I do not.

X Q. 67. Look at defendant's Exhibit George E. Hawes No. 3, and feel the teeth in that and state to the court whether some of them are not now loose.

(Objected to as not cross-examination, said exhibit not having been referred to in examination-in-chief.)

A. Point out one that is loose.

531 X Q. 68. Feel the right central incisor, and say whether that is not a loose tooth.

A. It can be moved slightly by pressure; it cannot be called a loose tooth; it is not fit to put in the mouth; it might last for years, and it might break the first day.

X Q. 69. Has not the tin been compacted around the teeth in Exhibit 11 by the use of a tool which would close up an opening, if there were one when the case came out of the mould?

A. No further than the burnishing.

X Q. 70. Question repeated.

A. I have endeavored to give a full answer.

X Q. 71. Has not that metal been compacted around the teeth since the case came out of the mould?

A. In burnishing, the surface of the metal is condensed, and in consequence should there be a minute vacancy between the tooth and the yielding metal; this most probably would force the metal in actual contact with the tooth. No further packing has been used.

X Q. 72. Can any further be done by any means than to force the metal into contact with the teeth? If so, what else could be done to make the set of teeth any better with that material?

A. Any large cavity could be filled by flowing melted tin upon it or in it.

X Q. 73. When the case comes out of the mould without any large cavity, what more can be done than you did when manufacturing Exhibit 11, in order to get a close contact between the teeth and the metal?

A. I do not notice anything in this case, further than the defect just referred to could have been closed by pressure from the present appearance.

X. Q. 74. When did you begin to manufacture vulcanite plates?

A. The first I made was in 1860.

X Q. 75. What improvement in the dental art, within your experience, has been equal, in importance and benefit to the public, to the improvement known as the vulcanite dental plate?

A. While I look upon the vulcanite base as valuable in many cases, I think that the public have been more benefited by the improved method of preserving the natural teeth.

X Q. 76. What do you mean by that? Name the improvements you refer to.

A. More particularly the improved methods of filling teeth, and appliances to assist in the operation.

532 X Q. 77. Specify the improvement or improvements to which you refer, and state who invented them, and when they were invented.

A. The improvements in operations have been progressive, and I cannot specify any particular individual in this progress of advancement. I can enumerate, as appliances used, the electric mallet or plugger, Lewis's automatic plugger, and several other instruments, the same object.

X Q. 78. Then do you mean to tell the court that you consider Lewis's automatic plugger, whatever that may be, to be an invention superior in importance and value to the public to the vulcanite dental plate?

A. I do not; I merely mention it as one of the improvements or appliances among the many used in operating upon the teeth.

X Q. 79. Are there not great numbers of inventions of the class you have referred to?

A. Yes, sir.

X Q. 80. Do you mean, then, that you think that all these numerous inventions, taken together, are equal in value and importance to the one represented in the dental vulcanite plate; and, if not, how many of

these numerous inventions, taken together, would you consider equal in importance to the one exhibited in the dental vulcanite plate?

A. As already stated, I believe the improvements in operating upon the natural teeth have been of more value to the public than the introduction of the vulcanite plate. I cannot strike the balance as requested in the question.

X Q. 81. Has there been any one great improvement in the dental art within your experience which compares in importance with the dental vulcanite plate? If so, name it, and who was its inventor?

A. The improvements, as I have already stated, have been progressive, and we can't perhaps fix any great improvement at any particular date, or by any particular person.

X Q. 82. Don't you know that there has been no invention in the dental art within your long experience which is equal in importance to the dental vulcanite plate?

A. I do not; I may differ much from many of my professional brethren, but I look upon the universal introduction of the vulcanite plate with disfavor.

X Q. 83. Name the other invention which you consider superior
533 to it. Is it the "plugger" you have mentioned; if not, what other invention or instrument is it?

A. In my previous answers I have already stated that I deemed the improvements made in the operative department, and appliances used, of more value to the public than the introduction of the vulcanite plate; I cannot state any particular one.

X Q. 84. Is not the reason why you differ from your professional brethren in regard to the general use of the vulcanite plate, that by its introduction the dental art may be practiced for the purpose of manufacturing artificial teeth by persons who are not otherwise qualified to be dentists, or to take a diploma at a dental institution?

(Objected to as assuming facts not stated by the witness, that the art may be practiced, etc.)

A. That is not my sole reason.

X Q. 85. Is not that one of the reasons which influence your opinion?

A. I may say it is, for many persons wholly unqualified to practice dentistry can put up a rubber set without a knowledge of its proper adaptation.

X Q. 86. I now have Byrne's Practical Metal-Worker's Assistant, and I find on the 248th page a description of casting molten metal around other metals already formed. The author states as follows: "After the mould is closed about six or eight times, as much hot metal as the flange requires is poured through the mould; this heats the pipe to the temperature of the fluid iron, so that on cooling the flange is attached sufficiently firm to bear the ordinary pressure of screw-bolts, steam, etc." Is this the information which led you to suppose that melted metals were attached best by having the object to which they were to be united cooler than the melted metal themselves? If not, point out in that book the information upon which you founded your opinion.

A. It is not. This is entirely a different subject, describing the burnings or soldering two pieces of metal together by casting a molten metal against another metal surface. I merely say so far, after investigation, I cannot find it in the book named.

X Q. 87. Where did you get the metal of which No. 11 is cast, and how do you know it is commercially pure tin?

A. I got it at Bullock & Crenshaw's. I bought it for the best and

finest quality of tin in the market, and find it sufficiently pure for a delicate chemical operation. Where tin containing much impurity would spoil the result, this lot has operated satisfactorily.

534 Re-examined:

Q. 1. Please state whether, when Exhibits 11 and 15 were put in evidence, either of them had a tooth broken out, as each of them has now.

A. They had not, nor had either of them.

Recross-examined:

X Q. 1. Are not both of these broken teeth cracked where the platinum pins penetrate the porcelain?

A. Yes; they are both fractured.

X Q. 2. Is not platinum a better conductor of heat, and more expanded by heat, than porcelain?

A. It is, and does.

X Q. 3. Is not the natural tendency of those platinum pins, when heated by the melted tin, to crack the tooth in which they are imbedded?

A. Where the heat was applied too suddenly, or where the platina was large in a small delicate tooth, the sudden expansion of the platina would be liable to fracture the tooth; but not so liable as soldering a tooth to a gold plate.

X Q. 4. Question repeated.

A. The tendency would be under the conditions just enumerated.

X Q. 5. Is not the tendency of those pins to crack the teeth when melted tin is poured into the mould in any way you know how to pour it?

A. I do not think if the teeth were heated up to the melting point of tin that the melted tin coming in contact with them at the same temperature would have any tendency to crack them.

X Q. 6. Is not the tendency of the pins to crack the teeth if you heat them up to the temperature of melted tin preparatory to moulding, by reason of the greater expansibility and conductivity of the metal?

A. It would be if the teeth were heated up suddenly, especially so if the platinas were disproportionately large for the teeth.

X Q. 7. Can you alter the difference of expansibility between platinum and the china that imbeds it by heating them up slowly?

A. No, sir.

X Q. 8. How can you destroy the tendency, then, of that greater expansion to burst a tooth?

535 A. By applying this expansive force gradually, the porcelain is better able to resist this force than when suddenly applied.

X Q. 9. Is not the right central incisor of No. 11 also cracked at the place where the pins are inserted in it?

A. It appears to be cracked at that point in front. I do not think it was cracked when placed here or delivered from my hands.

X Q. 10. Did you examine it carefully at that time, with a view to detecting any crack that might exist?

A. I did not particularly examine it; but it is so conspicuous now, if it then existed, I don't think it would have escaped my observation.

X Q. 11. Haven't you looked at that plate several times this a. m., and particularly at the broken tooth next to the cracked one, without observing the crack, until your attention was called to it by me, after you had examined the plate in the manner suggested in this question?

A. Yes.

X Q. 12. If you failed to observe the crack when looking at the broken adjacent tooth, why do you suppose you would have seen it before that adjacent tooth was broken out, and before you brought it here?

A. I cannot give any reason. I don't know.

X Q. 13. Did you not carefully examine this plate this a. m., when the toothpick test was applied to it and before the broken tooth fell out of the plate?

A. I gave the case a general examination; not very critically.

X Q. 14. Did you see the crack in either of the teeth?

A. No, sir.

X Q. 15. Is it not certain that both of those teeth must have been cracked then?

A. I am not certain that they were.

X Q. 16. Have they been out of your sight since, except when you turned your eyes away from the table?

A. They have, in the hands of the counsel.

X Q. 17. Can you suggest any way that those teeth, if they were sound an hour ago, could be cracked now, consistently with what you have seen done with them at the table where you and the counsel were sitting? If so, tell the court how you think it was done.

A. I have not seen anything done with them. I cannot suggest any way.

536 X Q. 18. If one of the teeth in this sort of plate should be cracked in the process of manufacture, does not that destroy the whole case?

A. No, sir.

X Q. 19. How could you remedy that consistently with having a cast metal plate when the work was done?

A. By removing the broken parts, fitting a proper tooth in position, and flowing block tin around the tooth.

X Q. 20. When that was done would that be a homogeneous plate, just as if it had not been done?

A. I think it would.

X Q. 21. Do you think that a cast tin basin which has a hole knocked out of it, and which is mended by flowing in with a soldering-iron, or otherwise, with new metal, is then a homogeneous vessel?

A. If the orifice is filled with the same metal, and the points of contact between the two parts are firmly united by having been fused together, it may be termed a homogeneous vessel.

X Q. 22. In making a gold plate by soldering on teeth, if a tooth be broken in the process, is not the reparation merely a repetition of the original process of construction?

A. Yes, so far as it goes.

ELIAS WILDMAN.

Sworn and subscribed before me this 13th day of November, A. D. 1873.

Examiner.

Exhibit Wildman's License.—Aubrey H. Smith, Examiner.

Whereas letters patent of the United States were granted unto Nelson Goodyear, bearing date the sixth day of May, 1851, for an improvement in the manufacture of India-rubber and allied gums;

And whereas the said letters patent were surrendered on account of

a defective and insufficient specification by Henry B. Goodyear, as administrator of the said Nelson Goodyear, deceased, and thereupon two new letters patent were granted for different parts of the said invention for the residue of the unexpired term for which the original letters patent were granted, one of the said new patents being for the new product, manufacture, or substance known as the hard compound of vulcanized caoutchouc, or India-rubber, and allied gums, and the other for
537 the improved process for producing the said product or substance, both of which said new letters patent bear date the 18th day of May, 1858;

And whereas the American Hard Rubber Company, of Flushing, New York, are the owners by assignment of the right, under the before-recited letters patent, of working the said process, and producing, applying, and vending the said substance, as applied to dental purposes;

And whereas E. Wildman, of Philadelphia, county of Philadelphia and State of Pennsylvania, is desirous of acquiring the right, privilege, or license of working the said process, and using the said substance for artificial gums, or plates for artificial teeth, in his own business as a dentist, and to practice the same in the said city of Philadelphia, and nowhere else;

Now this agreement, made the twenty-fifth day of June, A. D. 1864, between the said American Hard Rubber Company of the first part, and the said E. Wildman of the second part, witnesseth, that the party of the first part, for and in consideration of the sum of one dollar, paid to them by the party of the second part, the receipt of which is hereby acknowledged, and the faithful performance by the party of the second part of the conditions herein specified, doth hereby grant to the party of the second part a right, privilege, or license, under the two before-named patents, to work the said process for the production of artificial gums, or plates for artificial teeth, and for no other purpose, and to vend the gums and plates thus prepared within the said city of Philadelphia, and nowhere else, during the residue of the time for which said letters patent were granted, upon the following conditions, and to cease and to become of no effect in the event of the failure to comply with any one or all of the conditions herein specified:

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Fifth. All improvements made by the said E. Wildman, or by those employed by him, in the compounds or mixtures of gum used for vulcanizing, or in the process or method of working or vulcanizing the same, shall be for the benefit of the said American Hard Rubber Co., and their licensees, as well as for that of the said E. Wildman.

Seventh. And the party of the second part, for and in consideration

X Q. 12. If you failed to observe the crack when looking at the broken adjacent tooth, why do you suppose you would have seen it before that adjacent tooth was broken out, and before you brought it here?

A. I cannot give any reason. I don't know.

X Q. 13. Did you not carefully examine this plate this a. m., when the toothpick test was applied to it and before the broken tooth fell out of the plate?

A. I gave the case a general examination; not very critically.

X Q. 14. Did you see the crack in either of the teeth?

A. No, sir.

X Q. 15. Is it not certain that both of those teeth must have been cracked then?

A. I am not certain that they were.

X Q. 16. Have they been out of your sight since, except when you turned your eyes away from the table?

A. They have, in the hands of the counsel.

X Q. 17. Can you suggest any way that those teeth, if they were sound an hour ago, could be cracked now, consistently with what you have seen done with them at the table where you and the counsel were sitting? If so, tell the court how you think it was done.

A. I have not seen anything done with them. I cannot suggest any way.

536 X Q. 18. If one of the teeth in this sort of plate should be cracked in the process of manufacture, does not that destroy the whole case?

A. No, sir.

X Q. 19. How could you remedy that consistently with having a cast metal plate when the work was done?

A. By removing the broken parts, fitting a proper tooth in position, and flowing block tin around the tooth.

X Q. 20. When that was done would that be a homogeneous plate, just as if it had not been done?

A. I think it would.

X Q. 21. Do you think that a cast tin basin which has a hole knocked out of it, and which is mended by flowing in with a soldering-iron, or otherwise, with new metal, is then a homogeneous vessel?

A. If the orifice is filled with the same metal, and the points of contact between the two parts are firmly united by having been fused together, it may be termed a homogeneous vessel.

X Q. 22. In making a gold plate by soldering on teeth, if a tooth be broken in the process, is not the reparation merely a repetition of the original process of construction?

A. Yes, so far as it goes.

ELIAS WILDMAN.

Sworn and subscribed before me this 13th day of November, A. D. 1873.

Examiner.

Exhibit Wildman's License.—Aubrey H. Smith, Examiner.

Whereas letters patent of the United States were granted unto Nelson Goodyear, bearing date the sixth day of May, 1851, for an improvement in the manufacture of India-rubber and allied gums;

And whereas the said letters patent were surrendered on account of

a defective and insufficient specification by Henry B. Goodyear, as administrator of the said Nelson Goodyear, deceased, and thereupon two new letters patent were granted for different parts of the said invention for the residue of the unexpired term for which the original letters patent were granted, one of the said new patents being for the new product, manufacture, or substance known as the hard compound of vulcanized caoutchouc, or India-rubber, and allied gums, and the other for
537 the improved process for producing the said product or substance, both of which said new letters patent bear date the 18th day of May, 1858;

And whereas the American Hard Rubber Company, of Flushing, New York, are the owners by assignment of the right, under the before-recited letters patent, of working the said process, and producing, applying, and vending the said substance, as applied to dental purposes;

And whereas E. Wildman, of Philadelphia, county of Philadelphia and State of Pennsylvania, is desirous of acquiring the right, privilege, or license of working the said process, and using the said substance for artificial gums, or plates for artificial teeth, in his own business as a dentist, and to practice the same in the said city of Philadelphia, and nowhere else;

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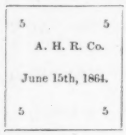
Seventh. And the party of the second part, for and in consideration

of the rights and privileges herein granted, hereby covenants and agrees to hold the within granted rights and privileges, subject to the terms and conditions herein specified, and that in case of failure on his part to comply with all or any of them, then this license shall ever after be null and void.

This license shall not be valid unless countersigned by Bradley W. Franklin, agent of the Patent Vulcanite Dental Agency.

In witness whereof the parties to these presents have hereunto set their hands and seals the day and date above mentioned.



[L. S.] AMERICAN HARD RUBBER CO.

M. LACHEMAN, *Secretary.*

BRADLEY W. FRANKLIN, *Agent.*

An adjournment here had until 3 o'clock p. m., by consent of counsel.

THURSDAY, *November 13th*, 1873.

EDWARD C. FORD, being duly sworn, deposes and says:

I am about thirty-eight years of age; reside in Laurel, Maryland; my occupation is a model-maker in the United States Patent Office, Washington.

Q. 1. Have you been authorized by the Commissioner of Patents to bring here from the Patent Office the model of John A. Cummings, of Boston, Massachusetts, for improvement in artificial gums and palate, patented June 7th, 1864? And if yea, produce the same before the examiner.

539 A. I have. (Witness produces the model.)

Q. 2. Are the cards attached to said model official, and part of the files of the Patent Office?

A. To the best of my knowledge they are, sir.

(Counsel for defendant requests examiner to copy the writing from each of said cards.)

J. A. Cummings.
Artificial teeth.
Rec'd March 25th,
1864. '64.

John A. Cummings, of Boston, Mass.
Insertion artificial gums and plates.
Pat'd June 7th, 1864. '64.
(On back:) "43,009."

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Again M'ch 21st,
1865. '65.

1904.

(On back:) "1904."

Q. 2. Look at the model, having attached thereto a Patent Office certificate, now shown you, and state whether you have compared that with the said original model; and, if yea, how far the two agree with or differ from each other.

540 A. I have compared them. The only difference that I perceive is the color of the material—what that is I am not prepared to testify—and one pin more projecting through the right-hand side of the palate than in the original.

(Said model is put in evidence and marked Exhibit Duplicate Cummings Model.)

EDWARD C. FORD.

Sworn and subscribed before me the 13th November, 1873.

AUBREY H. SMITH,
Examiner.

ASA HILL being duly sworn:

Q. 1. What is your age, residence, and occupation?

A. My age is fifty-seven years; my residence, Norwalk, Conn.; I am a dentist.

Q. 2. How long have you been engaged in dentistry, or its practice, at Norwalk, Conn.?

A. Well, in the neighborhood of thirty-five years.

Q. 3. In the course of that practice have you used any, and, if yea, what materials or substances, as substitutes for gold or silver dental plates?

A. I have used a composition known as Hill's stopping, pure gutta-percha, and metal composition known as Cheoplastic, vulcanite, platinum, iridium, and compound collodium, what is known as celluloid also a composition known as Colburn's base. Those are all I recall at present.

Q. 4. State when you first used pure gutta-percha as a base, and describe how you formed the same into a dental plate.

A. I doubt if I could give you the date when I first experimented with pure gutta-percha. I suppose it might be ascertained about the date of its use incidentally; I can't remember exactly.

Q. 5. Which did you use first, pure gutta-percha, or Hill's stopping composition?

A. As it occurs to my memory now, Hill's stopping composition seems to have been used first, and yet from an article I was reading in the American Dental Journal, published, I think, in 1853, I make reference to the use of pure gutta-percha, in a letter to its editor, Dr. Harris.

541 Q. 6. When did you use the Hill's stopping composition as a base, as nearly as you can recollect?

A. In 1851, in May, I think, although I did use it before that; I can't remember the date distinctly; I remember using it in a single instance, I think, prior to that.

Q. 7. During what time did you use that composition for dental plates, and to what extent?

A. I can only answer that in a general way. I used it for several years, and in numerous instances.

Q. 8. When did you last use it in your practice?

A. I can't say.

of the rights and privileges herein granted, hereby covenants and agrees to hold the within granted rights and privileges, subject to the terms and conditions herein specified, and that in case of failure on his part to comply with all or any of them, then this license shall ever after be null and void.

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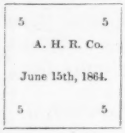

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Q. 2. How long have you been engaged in dentistry, or its practice, at Norwalk, Conn.?

A. Well, in the neighborhood of thirty-five years.

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541 Q. 6. When did you use the Hill's stopping composition as a base, as nearly as you can recollect?

A. In 1851, in May, I think, although I did use it before that; I can't remember the date distinctly; I remember using it in a single instance, I think, prior to that.

Q. 7. During what time did you use that composition for dental plates, and to what extent?

A. I can only answer that in a general way. I used it for several years, and in numerous instances.

Q. 8. When did you last use it in your practice?

A. I can't say.

to make them of rubber; then form another plaster model over the first, what is called a female model, then separate the two, carefully removing all the wax or gutta-percha, as the case might be, cutting waste gates for the surplus metal, forming an opening into which to run the metal, putting the two models together in an iron flask that would hold them firmly, then heat the whole hot, and while hot—having my composition metal in a ladle, melted—run it into the matrix thus formed, and when cold, remove the piece and finish it.

Q. 25. When you remove the wax or gutta-percha from the model, after separating the two parts of the model as you have stated, in what position did the teeth remain, and how were they held in that position?

A. They remained as they were adjusted for the mouth, held in position by the plaster.

Q. 26. How was this cheoplastic method designated, or by what name known in the profession?

A. Blandey's method, or the cheoplastic process.

Q. 27. Have you any memorandum to which you can refer, and give the dates at which you made some of the plates of Hill's composition as you have described?

(Objected to.)

A. I have.

Q. 28. Please refer to it, and give them.

(Objected to.)

A. Just before leaving home to come to Philadelphia I copied the following memorandum from my dental register or record of operations. In May, 1851, I find the following entry: "This day I inserted in the mouth of Miss Eliza Curtis, of Norwalk, front and lateral superior incisors on what is known as Hill's stopping, colored to resemble the gums. Inserted six teeth on composition base for Mrs. Elizabeth Weed, with artificial gums. Nov. 1st, 1851, inserted four on compound base
545 for Asa E. Smith. Nov. 26th, inserted seven on compound base for Miss Amelia Jarvis. Dec. 24th, inserted two on compound base for John Hall. Sept. 27th, 1854, made set for Mrs. Canker. Sept. 28th, 1854, put in two teeth for Mrs. Lester Moore on composition base. Nov. 12th, 1855, gave instructions to Dr. Jas. G. Barbour in the use of gutta-percha base." I never expected to give testimony on these subjects, and these notes were copied before leaving home when I found I was to be examined.

Q. 29. When did you commence using hard rubber dental plates?

A. I can't tell you. I used them under a license from Franklin; I can't tell the date now.

Q. 30. Can you tell how many years you used them?

A. No, sir; I used it to a very limited extent; never to any large extent.

Q. 31. Did you use the cheoplastic plates to any extent; and, if yea, to what extent?

A. I used them for several years to a limited extent. My business was mainly confined to operations on the natural organs; but having incidentally artificial dentures to supply for my patients.

Q. 32. State whether or not in your use of the cheoplastic plate you found them practically useful.

A. I did.

Q. 33. State whether or not the Hill stopping composition plates possessed and retained in use sufficient rigidity for purpose of mastication.

A. They did.

Q. 34. State whether or not those plates were pliable enough to yield a little to the motions of the mouth?

A. They were. Of course they were not absolutely rigid, they were semi-elastic; that remark applies more especially to the thin portions of the plate.

An adjournment was here agreed upon until Friday, Nov. 14th, A. D. 1873, at 10 o'clock a. m.

FRIDAY, *November 14th*, 1873.

Parties in interest reappeared, pursuant to adjournment, at 10 o'clock.

X Q. 1. Are you willing to let us so far into the secret of your invention practiced in 1851 as to say whether or not that dental plate was composed of vulcanite?

546 A. Yes, sir; I am willing. It was not.

X Q. 2. What object were you attempting to accomplish when you made that invention, and what difficulty in the dental art were you endeavoring to overcome?

A. Primarily I was laboring to produce a plastic filling for teeth; incidentally and secondarily my experiments had in view a dental plate easily prepared and useful.

X Q. 3. Did you at that time consider it a very desirable object to discover or invent a dental plate which would be easily prepared, cheap and useful?

A. I did.

X Q. 4. Was there, at that time, such a thing known?

A. I don't think there was such a thing known at that time; I certainly thought it very desirable to achieve it.

X Q. 5. Didn't it appear to you, at that time, that such an achievement would bring a large pecuniary reward?

A. I suppose it did.

X Q. 6. When you had got through with your experiments in that direction, did you suppose that you had succeeded in achieving it?

A. I have never got through my experiments to this day.

X Q. 7. Up to the last accounts you have given us, namely, 1854, di you suppose you had achieved the desired result?

A. Only in part, or relatively so.

X Q. 8. Did you at that time suppose that you had produced a practically useful dental plate, so far as you had then carried your experiments?

A. I did.

X Q. 9. What measures did you take, when you had achieved your success, for reaping the pecuniary reward you had anticipated from your labors?

A. None other than to publish my progress to the world that I recall now.

X Q. 10. Did you make the publication under date of Nov. 9th, 1853, which is proved in this case, for the purpose or with any expectation of deriving any pecuniary reward therefrom or thereby?

A. I judge that was not the primary object of the publication.

X Q. 11. Was that any part of the object of that publication?

A. I cannot now affirm that it was.

547 X Q. 12. Don't you think that upon the whole that publication was a rather discouraging advertisement if pecuniary reward was in any way involved in its object?

A. No, sir.

X Q. 13. Did you make any other publication that was more encouraging than that? and, if so, produce it.

A. I don't know that I did. There was another publication made in the Dental Recorder similar to it.

X Q. 14. Was that publication in regard to dental plates?

A. Yes, sir; it had reference to the same matter.

X Q. 15. You said that you had never got through with your experiments to this day. When, after 1854, did you try your next experiment, and what was it?

A. I have been trying all along various experiments, with that object in view.

X Q. 16. Has it resulted from those experiments that you have brought your dental plate to any higher perfection than it was in 1854, when you give us the last account of it?

A. I think I have made some valuable information, but none that fully satisfies me.

X Q. 17. After adding those valuable improvements to your invention as it was in 1854, have you yet brought your dental plate to such a condition that it is in practical use? If so, who uses it, and where?

A. My dental plate has not and does not fully meet all my views, and I have not introduced it to any considerable extent in practice.

X Q. 18. Is there one in use? If so, where, and who owns it? I mean the dental plate constructed according to your secret, whatever it was, and any improvements thereon which you have made since 1854.

A. Since that time I have patented a process differing from the one heretofore described. The question is somewhat involved; I wish to get it straight in my mind. I was going to remark that I had patented a process which at the time I thought to be an improvement, but which has failed to satisfy me; some of the plates of which I believe are now in use.

X Q. 19. Describe the invention you thus patented, and give the date of the patent.

A. I can't give you the date of the patent; I cannot recall the year; I think within five years. The invention related to the use of collodium, or pyroxyline, as we sometimes call it. It is analogous to the celluloid process.

548 X Q. 20. The question I wish answered is, whether any dental plate, such as you made in 1854, and about which you have testified, is now in use.

A. I cannot say.

X Q. 21. Was the object of your patent to show some cheap and practical dental plate out of which you might derive a pecuniary reward?

A. That was one object; I suppose the object was twofold.

X Q. 22. Why didn't you patent your dental plate of 1854, if you considered it to have achieved the practical success which made it valuable and desirable to the public?

A. I thought it unnecessary.

X Q. 23. Why did you think it necessary to patent your invention in the same general direction five years ago?

A. I thought it a valuable thing, and wished to secure its advantages.

X Q. 24. And is it not also true that you didn't patent your invention of 1854 because you didn't think it valuable, and therefore didn't expect any return from the patent?

A. No, sir.

X Q. 25. Then in 1854 did you suppose that a patent for that invention would have been valuable property?

A. I did.

X Q. 26. Why didn't you patent it?

A. I thought I was protected sufficiently.

X Q. 27. Were not the pivot teeth which you used perforated from the bottom upwards with holes, which were designed to be filled with wooden pins, the projecting ends of which were intended to be inserted in corresponding holes, to be drilled in the roots of the teeth left in the mouths of patients?

A. They were, as I apprehend the question.

X Q. 28. How deep were these holes in the teeth?

A. I should think ordinarily about one-eighth of an inch, maybe a little over, according to size of the teeth.

X Q. 29. When the teeth were warmed and pressed down upon the solid compound, did not the base of the tooth imbed itself first into the compound before the hole was filled by the pressure?

A. I suppose the two things were coincident.

X Q. 30. Did the compound fill these holes when the tooth was pressed down upon it?

A. Not entirely in all cases.

549 X Q. 31. Did it entirely when the operation was properly performed?

A. I considered it an advantage, but not indispensable, to be entirely filled.

X. Q. 32. (Question repeated.)

A. I regard the operation properly performed if the cavity was half filled with the compound, but preferred it entirely filled; the atmospheric pressure sometimes prevented that, except when especial pains were taken in pressing the tooth upon the compound.

X Q. 33. How did you find out whether the cavity was partially or entirely filled?

A. I knew by frequent observation on the subject, and by practice.

X Q. 34. Is there any way known to man by which you could ascertain whether the pivot-hole in the underside of a tooth which had been pressed down upon a bed of plastic material was totally or only partially filled by that material? If so, describe the means by which that could be ascertained, and at the same time you are doing that, explain to the court how you think the air contained in that hole got out to make room for the soft material that was being forced up into it, while the base of the tooth was also being bedded into it.

A. I apprehend the difficulties in the question, and would say, in the first place, I think there is; in the second place, by removing the teeth after such pressure, and examining them. I think a portion of the air might escape, if pains were taken in pressing the tooth upon the material, and the remaining air in the cavity would be condensed. I can't tell how the air would get out, I am sure, except by the process named.

X Q. 35. Did you in your practice ascertain whether the holes were filled, or not, by taking the teeth up, after they were bedded for that purpose?

A. I did, in many instances.

X Q. 36. And did you find that the holes were filled with the compound?

A. No; only partially filled.

X Q. 37. Did you ever find a case in which the hole was filled with that compound?

A. I used to use some teeth that were perforated through entirely, and in those cases they were entirely filled.

X Q. 38. Were such teeth as that on sale at that time for front teeth?

550 A. I think they were.

X Q. 39. What was the object when wooden pins were used for boring the holes all the way through the teeth?

A. The object was to secure the teeth to the plate.

X Q. 40. Were any pivot front teeth for wooden pins made and sold in 1854, or before it, with the hole for the wooden pivot made all the way through the tooth?

A. I cannot say that they were—those technically known as pivot teeth, but other front teeth were.

X Q. 41. On your oath, do you believe that any such pivot teeth were sold in the market at that time?

(Objected to, the witness having answered that he could not say they were.)

A. As a general thing, I do not believe they were, but I am strongly impressed that I have used such teeth.

X Q. 42. You said in your direct examination, that what you first used were "what were known to the profession as pivot teeth." Were the pivot teeth referred to by you made with holes all the way through them?

A. No, sir.

X Q. 43. Now, I ask you whether you ever got one of those holes in those teeth filled with this compound, by the process you have described?

A. I think I have already stated that they were not absolutely, but partially, filled.

X Q. 44. How could any part of the air in that cavity get out in performing the operation you have described?

A. By the method of applying the pressure.

X Q. 45. Did you apply the pressure in such manner as to let the air out? If so, tell the court through what channel it escaped; was it through the pores of the teeth, or through the joint between the hot tooth and the plastic material on which it was being pressed, or through the pores of the material itself?

A. Neither. By lifting the tooth and rocking it in such manner as to permit a portion of the air to escape; a tooth warmed and pressed upon this composition will receive a portion of it in the pivot holes.

X Q. 46. Does the air escape or not in the process you have described? And, if so, through what channel does it escape?

A. I do not think the air entirely escapes in such cases, but sufficiently so for practical purposes.

551 X Q. 47. Is not the tooth air-tight?

A. It is supposed to be.

X Q. 48. Is not the plastic material air-tight?

A. Yes.

X Q. 49. Is not the joint while the tooth is pressed upon the plastic material air-tight?

A. I suppose it is.

X Q. 50. Then where does the air escape?

A. I suppose a portion of it escapes by the movements which are introduced in placing the tooth in position.

X Q. 51. Air don't escape through a "movement," does it? Must there not be a passage for its escape?

A. A movement sometimes makes a passage.

X Q. 52. Where did your movement make the passage for the air to escape?

A. Very often I lifted the tooth and readjusted it; sometimes I gave it a rocking motion for the purpose of allowing the air to escape. I have in some cases filled the cavity with compound before pressing it to its position.

X Q. 53. When you lifted the tooth which way did the air flow, out from the cavity or into it, from below?

A. If the air was compressed it flowed out.

X Q. 54. After the "flowing out" operation you have described, was there any less air in the cavity than when you first began the operation; and, if not, how did the "lifting" operation help you to empty the air out of the cavity?

A. I suppose there was no less air than when I commenced the operation, but the compressed air was relieved. The practical results were satisfactory in either case.

X Q. 55. If the lifting operation did not diminish the quantity of air in the hole, how did the "rocking" operation do it? Can you "rock" air out of a hole in the tooth? If so, explain to the court how the "rocking" does it, and through what passage it escapes.

A. It seems to me very simple indeed; if a cavity containing the air be filled with a piston, the rocking motion allows it to escape, forces the air out necessarily, unless it be so rigid as to admit of no rocking motion.

X Q. 56. When you "rock" the tooth, through what passage did the air escape?

A. Through the orifice, if at all.

X Q. 57. Did it escape through the orifice?

552 A. I suppose it did to some extent. Perhaps such a question can only be proved by demonstration.

X Q. 58. If it did escape in that way, must it have not passed out between the base of the tooth and the plastic compound?

A. I suppose so.

X Q. 59. Could it so escape without opening the space between the tooth and compound?

A. No, sir; I don't see how it could.

X Q. 60. Could that space be opened unless the pressure was relieved upon the tooth while the escape was made?

A. I don't know that it could be. These may present questions in philosophy which it may trouble me to answer.

X Q. 61. If the pressure upon the tooth was relieved, what force then would drive the compound into the cavity and the air out?

A. I suppose it is possible that a lateral rocking force might do that.

X Q. 62. Do you think any lateral rocking force on the handle of a sausage machine would drive the material out of the spout?

(Objected to as incompetent and irrelevant, and impertinent, the witness not having been offered or examined in chief as an expert, and these speculative interrogatories being put by the counsel in a manner as objectionable as the matter of it is irrelevant.)

A. I think it possible it might, though it would not be the best way to get it out.

X Q. 63. Then did you get your compound into the cavity by a lateral motion, and not by a downward pressure?

A. By both; it will go into the cavity to a convenient extent by the most direct pressure.

X Q. 64. Is it possible that any of it can be forced upwards into the

cavity when the pressure downwards is relieved from the tooth? If so, explain to the court what the force is that compels the soft compound to ascend into the cavity.

A. I don't know that it can; I would not say that it could.

X Q. 65. Do you think it could?

A. I think there must be direct or indirect pressure to force it upwards. That pressure may be square, direct, or lateral and indirect.

X Q. 66. Can any be forced up until the downward pressure is great enough to overcome the cohesion of the material, and cause its particles to remove to some place where they can be relieved from the downward pressure by escaping into the cavity or protruding around the base of the tooth?

553 A. I think it may be by a compression of the air in the cavity, and not by the displacement of the material itself.

X Q. 67. Is it not the tendency of the compressed air to force the material out of the cavity instead of into it?

A. I suppose it is. Sufficient pressure would overcome that tendency.

X Q. 68. Well, must not that pressure be downward on the tooth, so as to squeeze the material upward into the hole?

A. I suppose it must.

X Q. 69. While that pressure, then, is being exerted, must not the joint between the base of the tooth and the compound be air-tight?

A. I think not necessarily.

X Q. 70. Then, must it not be true that a pressure less than sufficient to make an air-tight joint between the flat base of the tooth and the compound, is yet quite sufficient to force that compound up into that small hole?

A. I think not.

X Q. 71. Is that book from which you copied your memorandum your private account-book?

A. It is my private record of dental operations.

X Q. 72. Was it intended for any other purpose than your own private information?

A. Substantially not; yet I would state that whenever I made such an entry I had an eye to the date of those operations, whatever might transpire. Of course, anything like this never entered my conception.

X Q. 73. Do you enter all your operations in that record?

A. Yes, sir; it is the rule.

X Q. 74. I find in your entry of May, 1851, that you entered the statement of an operation in which you say you used "what is known as Hill's stopping." Who was the person referred to there by that name?

A. I am the person.

X Q. 75. Are you the Mr. Hill referred to in that entry in your own book for your own information?

A. I am.

X Q. 76. Was Eliza Curtis a patient of yours?

A. She was.

X Q. 77. How long did she continue to be so?

A. I can't say.

554 X Q. 78. What was the result of that experiment?

A. Mutual satisfaction, I think, sir.

X Q. 79. Did the plate continue in use for a long time, and retain the qualities mentioned in your memorandum?

A. So far as I know, those teeth answered a good purpose. How

long they were worn I can't now say; it has passed out of my recollection.

X Q. 80. Did you ever see them again?

A. I can only give you my impression. I saw and watched them with interest for a considerable time afterwards. I can only give you my impression.

X Q. 81. Did they retain their good qualities and appearance as long as you continued to observe them?

A. Such is my present impression and conviction.

X Q. 82. About how long would you now say you continued to observe them? Was it as late as 1853?

A. I would not now state how long, but simply that my interest in the matter was such as to lead me to watch them for some considerable time.

X Q. 83. Did you watch them long enough to become satisfied that the results were practically achieved?

A. In this individual case, as in others, I carefully watched them until the conviction was produced in my mind that it was a useful invention.

X Q. 84. In 1853, when you wrote and published as follows, "But I have not yet succeeded in making a gum color that would not fade or turn dark and livid under the influence of the action of the fluids of the mouth," had you forgotten how you had made Eliza Curtis's to stand the effect of the acids of the mouth, or was it your experience in her case that led you to write what you did?

A. It might have been experience in her case and in others, as to the coloring matter, not as to the material.

X Q. 85. Now, having your recollection refreshed by reference to your publication of 1853, are you still of opinion that Eliza Curtis's plate retained its good appearance as long as you continued to observe it?

A. I am not at all certain of it. I have no fixed opinion in reference to it.

X Q. 86. Was it true or false in 1853 that you had not then succeeded in making a gum color that would not fade or turn
555 dark and livid under the action and influence of the fluids of the mouth?

A. I have no doubt of its truth at the time the article was written.

X Q. 87. Was it true with respect to Eliza Curtis?

A. I cannot say it was not.

X Q. 88. Can't you say that it was?

A. I can't say that absolutely, because my memory is not specific as to that point in regard to her case.

X Q. 89. In 1853 did you suppose your invention to be anything more than a convenience for temporary uses?

A. In the general my reliance on it was chiefly for temporary purposes, but I had strong hopes of making it successful for permanent structures.

X Q. 90. Were those hopes ever realized?

A. Not to the full extent—neither with that or any other plastic base.

X Q. 91. Did you extract from your record all the entries that related to this material when used for dental plates?

A. No, sir.

X Q. 92. What others were there in that record, and when were they made?

A. I cannot, of course, answer what others the record may contain.

The time I had was so limited, after I was informed it was deemed important I should come here, that I had slight opportunity to examine the records thoroughly, but made my memorandum from such cases as presented themselves on a superficial examination.

X Q. 93. Were there any other entries relating to this subject between May 1st, 1851, and November 12th, 1855?

A. I feel quite assured there were a number.

X Q. 94. Why didn't you copy them when you copied these?

A. Because I thought it was not important to do so, and because my time was very limited. I supposed all that was essential in my testimony was to establish the fact that I made such dental fixtures.

X Q. 95. Will you now swear that within that period there were entries in your record relating to plates made of this secret compound which you read when you were making the investigation, and which you decided not to copy, for the reasons you have mentioned?

556 A. I have a strong impression such is the fact. I have not a doubt about it.

X Q. 96. Were the six teeth for Mrs. Weed a temporary or permanent set?

A. They were temporary and experimental.

X Q. 97. Were the four for Asa Smith a temporary or a permanent set?

A. I do not distinctly recollect as to that case, but presume they were experimental, like the others. That is true of pretty much all the cases I have quoted.

X Q. 98. Of which of them, if any, is it not true?

A. I don't know of any, sir. My memory is not specific on that point.

X Q. 99. About how warm was it necessary to make that compound in order to imbed the teeth in it or to mold it?

A. As to the degree of heat as measured by a thermometer, I cannot say, having never tested it in that way.

X Q. 100. Can you give no approximate statement of the degree of heat at which the material could be worked?

A. I think I can. I am enabled to do it simply from having read an article in the journal, to which, I think, reference has been had, stating that it became plastic sufficient to mould at 100° Fahrenheit. That is the only way I can approximate it. I will add, the degree of heat required to render it plastic is greater than the mouth can bear, so that there is no danger of taking fluids or food in the mouth sufficiently warm to make it plastic?

X Q. 101. When you wrote these words in 1853, "and the teeth are firmly held in their places by being stuck into the compound when slightly heated, without any other support," did you make a true statement of the fact?

A. I think I did. I presume I had reference to the teeth being slightly heated, instead of the compound.

X Q. 102. Did you mean that the teeth were slightly heated and the compound cold?

A. I suppose I did. That is still true.

Re-examined:

Q. 1. State whether or not you have ever removed from one of those compound plates that you have made any of the teeth that had the holes or cavities in them.

A. I have repeatedly removed them a great many times.

557 Q. 2. State whether or not you found, in such cases, any of the compound in the holes or cavities of those teeth.

A. I think I may say invariably.

Q. 3. You have stated in your cross-examination that there was another publication made in the Dental Recorder similar to the publication under date of November 9th, 1853, in regard to a dental plate. Please state when that publication in the Dental Recorder was made.

A. According to my recollection, it was made in the October number, 1851.

Q. 4. Look at the volume now shown you, being the New York Dental Recorder, devoted to the theory and practice of surgical, medical, and mechanical dentistry, vol. I, and referring therein to the article entitled "A new mode of setting artificial teeth," on pages 18, 19, and 20 of No. 1—October, 1851. State whether that is the publication you refer to.

A. That is the article I referred to.

(The said volume is put in evidence by the defendant, and the article referred to is marked Defendant's Exhibit No. 62. A. H. S., Examiner.

Recross-examined:

X Q. 1. Does that publication refer to the same matter about which you have testified in this case?

A. I believe it does.

X Q. 2. You say in that publication that "the proof of the pudding is in the eating." Did your pudding turn out to be what you thought it would be when compounding it in this publication?

A. To continue the theme, I think it very good "hasty pudding."

X Q. 3. Did you propose it for hasty pudding or for substantial eating when you made this publication?

A. For both, according to its merits.

X Q. 4. Did you ever carry it further than the experiments you have mentioned in your examination?

A. I think these statements I have made in this examination cover the ground thoroughly.

(It is agreed that a copy of the article referred to in the Dental Recorder, October, 1851, certified by the examiner, may be substituted in the record for the volume in which it is contained.)

A. HILL.

558 *True copy of Def'd't's Exhibit No. 62.—Aubrey H. Smith, Examiner.*

A new mode of setting artificial teeth.

The undersigned has invented and put in operation a plan by which artificial teeth may be mounted and secured in the mouth without the aid of metallic plates or springs of any kind. This device consists of an artificial compound substance (similar in its composition to "Hill's stopping") that can be easily moulded while in a plastic state over a plaster model of the mouth, and of a color resembling the natural gums. This substance can be moulded with perfect facility to any desired form, and soon becomes sufficiently firm and solid to hold the teeth in their places and sustain them in the mouth. Being formed in its plastic state, it can be made to fit any model in the most perfect manner, so that even single teeth or partial sets are easily retained in the mouth, without the

aid of ordinary springs or clasps, by means of atmospheric pressure alone.

The great ease and facility of working this substance enables the operator to extend it in any direction, and to mould it over the alveolar ridge in such a manner as to restore the contour of the face, no matter to how great an extent absorption of the ridge may have taken place.

It likewise obviates the necessity of gum teeth altogether, as a beautiful artificial gum may be easily formed of the substance itself.

The teeth are secured by moulding the compound around their base, without the necessity of backing or soldering in the ordinary way, and are easily restored in case of accident, without interfering with the rest. Entire or partial sets can be made with equal facility, and worn with great ease and comfort, as a perfect fit is readily obtained, and no sharp cutting edges are felt to irritate and fret the parts.

For under sets it cannot fail to commend itself, where firmness and solidity are so desirable, because of its extreme simplicity and convenience. For here the edges of the piece that rests upon the muscles can be made just as obtuse or round as the operator may desire and the circumstances of the case admit, and the alveolar ridge built up to any desirable form.

559 In short, this arrangement seems to to us reduce the difficult process of mounting artificial teeth to the greatest possible degree of simplicity, and we are at a loss to conceive how any mode more simple or economical can possibly be devised.

We are now ready to anticipate some of the questions and objections that will doubtless be started in the minds of our readers.

1st. Is the compound firm enough to sustain the teeth in mastication?

We answer, yes, abundantly so in most cases, and especially so where circumstances will alow a considerable degree of thickness over the alveolar border; and almost every case will allow this.

2d. Will it withstand the fluids of the mouth?

We answer, it will stand as well as "Hill's Stopping," and that will stand where there is no friction from mastication. But the proof of the pudding (as the old adage says) is in eating it," and time alone can test the durability of this arrangement. We have several pieces that are now being worn by our patients very successfully. One piece has been worn without the least alteration for more than six months, and that, too, under circumstances calculated to test it severely, and is likely to last an indefinite length of time to come.

For temporary sets we are certain they must succeed, and we have high hopes of something more, but time alone must settle this question.

For several months past we have been experimenting with respect to a gum-color, and have succeeded so well that we expect soon to offer it to the profession on such terms as may seem to us just and proper.

Oct. 22d, 1851.

A. HILL.

LEO H. DE LANGE being duly sworn:

Q. 1. What is your age, residence, and occupation?

A. My age is forty-nine years in January next; I reside at Bordentown, New Jersey; I am a dentist.

Q. 2. State if you at any time had a license or agreement from the American Hard Rubber Company to act as agent for the sale to dentists, in any of the cities and towns of the States of New York, Pennsylvania,

and New Jersey, for office rights to manufacture plates and gums for artificial teeth, under the Nelson Goodyear patent of May 6th,
560 1851, reissued May 18th, 1858; and, if yea, produce such agreement, to be annexed as an exhibit to this deposition.

A. Yes. I had; and I offer said agreement in evidence.

Q. 3 When was this agreement made?

A. January 3d, 1859.

Q. 4. State whether you had a certificate of such agency, and produce the same to be annexed as an exhibit.

A. I had; and offer said certificate in evidence.

Q. 5. When was that executed?

A. Same time as the agreement.

Q. 6. State whether you had a license under said Goodyear reissued patents, from the American Hard Rubber Company, to work the process and use the substance covered by said reissue for artificial gums or plates for artificial teeth; and, if yea, produce such license as an exhibit to be annexed hereto.

A. I had; and produce the same here. It was given me February 19th, 1859.

Q. 7. State whether or not, in January, 1859, you issued a circular as agent for the American Hard Rubber Company for the States of New York, Pennsylvania, and New Jersey; and, if yea, produce such circular to be annexed to this deposition as an exhibit.

A. I did; and produce such circular to be annexed as an exhibit.

(Said license or agreement, said certificate of agency, said license of February 19th, 1859, and said circular of January, 1859, are put in evidence, and marked respectively De Lange Exhibits 1, 2, 3, and 4.)

Q. 8. During what time did you exercise the rights conferred by the agreement of January 3d, 1859, and the license of February 19th 1859?

A. I don't think I acted as their agent over six months; it may possibly be a year. I used the rubber under the license up to its extent, which was during the life of that patent.

Q. 9. How long was that?

A. I used it from the date of the license until about two years ago, when I was enjoined from using it.

Cross-examined:

X Q. 1. Did you use it extensively during that period?

A. Not very extensively.

561 X Q. 2. Didn't you use it so extensively in violation of the Cummings patent, that a judgment for about twelve hundred dollars was recovered against you for such use?

A. I never acknowledged Cummings's patent that I know of.

X Q. 3. Didn't you have a little difference of opinion on that subject between you and the court, which resulted in a judgment against you of about twelve hundred dollars in favor of the Goodyear Dental Vulcanite Company, in consequence of your infringing that Cummings patent?

A. I was sued for using the rubber, under the extension of the Goodyear patent, without having a license.

X Q. 4. Did you violate that patent; the Goodyear, I mean?

A. I was under the impression my license held good for the extension of the patent; that is why I kept on using it.

X Q. 5. Were you not sued and enjoined under the Cummings patent?

A. I can't answer that question, because I never looked at the papers any more than to glance over them.

X Q. 6. Didn't you suppose that you are now under injunction?

A. I know I am.

X Q. 7. Did you suppose you were under an injunction not to violate a patent that expired nearly two years ago?

A. I went to Trenton in April, I think, of 1872, being summoned, with other dentists, for infringing on the Goodyear patent; I was then informed that I could not do any more work on the Cummings patent.

X Q. 8. Didn't you acquire that information in the shape of an injunction?

A. I couldn't recollect if it said anything about Cummings or not; I wouldn't like to say.

X Q. 9. Didn't your curiosity ever lead you to ascertain if you were enjoined under a patent that had ceased to exist, or whether you were enjoined under the Cummings patent?

A. I quit using the material at the time I was notified not to use it.

X Q. 10. Can you read print in English language?

A. Yes, sir.

X Q. 11. Did you ever read the printed injunction served on you?

(Objected to, as assuming that the witness has said that the injunction was printed.)

562 A. I glanced over it at the time; I suppose I did at the time.

X Q. 12. Did you not see in that injunction that you were commanded not to use the invention patented by Cummings?

A. I don't recollect.

X Q. 13. Did you never suppose until to-day that you were enjoined not to violate Cummings's patent?

A. I presume there was some difficulty about it, and so not to get myself in trouble I quit using it.

X Q. 14. Question repeated.

A. I don't understand the question.

X Q. 15. When the injunction was served on you, and you glanced over it, did you not suppose that it commanded you not to violate the Cummings patent?

A. When I received that paper, which you call an injunction, I presumed it was for infringing on the Goodyear patent.

X Q. 16. Did you continue of that impression after reading it, and until to-day?

A. I read in our journals that Mr. Cummings claims the right of inserting plates made of vulcanite rubber to the mouth. I believe, if I am not mistaken, at the time I was in Trenton, that they were going to hold the dentists for what they called the Cummings patent.

X Q. 17. Did not you derive that information from the paper served on you also?

(Objected to. And counsel for defendant submits to the court that in the absence of the injunction or a copy of it, the witness has been asked and answered often enough, and too often.)

A. I cannot recollect whether that was in the paper or not. I have answered that several times.

X Q. 18. Is your memory any better in respect to a judgment against you for about twelve hundred dollars in favor of the Goodyear Dental Vulcanite Company, for infringing the Cummings patent, or do you forget that?

A. I have always been under the impression that there is a judgment of about nine hundred dollars against me for infringing on the Goodyear patent.

X Q. 19. Does your memory serve you enough to say whether that judgment has been paid or not?

A. I have no recollection of its having been paid, sir.

X Q. 20. Who sent for or communicated with you in respect to being a witness in this case?

563 A. I was into Mr. White's some time ago, and I mentioned to him that I had some papers from the American Hard Rubber Company that may be of use to him. He told me to send them down.

X Q. 21. Who is Mr. White? Is it Samuel S. White, the publisher of the Dental Cosmos?

A. Yes, sir. He is the proprietor of the dental depot.

X Q. 22. Of what use did you suppose these old papers would be to Mr. White, when you volunteered to furnish them?

A. Only from the date of them being so far back.

X Q. 23. But what use did you suppose they could be to Mr. White in his business, and how did their dates make them valuable, as you understood it?

A. I didn't know whether they would be valuable to him or not.

X Q. 24. In what way did you suppose they would be useful to him; was it for wrapping paper or as literary curiosities that you supposed he would use them?

A. Don't you think that I knew that Mr. White was interesting himself on behalf of the dentists to resist what they consider a fraud? and I thought that the papers might be of use to him, which was my only reason for offering them to him.

X Q. 25. Did you suppose that it was the Goodyear patent or the Cummings patent that was to be resisted when you offered the papers?

A. I presume it was to test the validity of Cummings's claims.

X Q. 26. Did not you suppose that Mr. White was defending a lawsuit when you offered him those papers?

A. There was a lawsuit at the time; I couldn't tell if he was defending it, I was only taking some interest in the matter.

X Q. 27. Haven't you been asked or has it not been suggested to you to contribute to Mr. White some money to aid him in his defense of these lawsuits?

A. Our society called upon its members to raise a fund to resist all patents pertaining to dentistry, and discountenance any member from taking out a patent pertaining to dentistry. We raised a fund by monthly contributions; a committee was appointed for that purpose, but they have not yet taken any action in the matter.

X Q. 28. Are you one of that committee?

A. Yes, sir.

564 X Q. 29. Wasn't the money to be paid over to Mr. S. S. White when raised?

A. The money was to be used for the purpose that the resolution called for.

X Q. 30. Wasn't the resolution adopted at the suggestion or solicitation of Mr. S. S. White?

A. Not to my knowledge.

LEO H. DELANGE.

(In the temporary absence of the Examiner, this witness was duly sworn, by consent of counsel, by Mr. Chas. T. Schively, notary public.)

Sworn and subscribed before me this 14th day of November, A. D. 1873.

CHAS. T. SCHIVELY,
Notary Public, 206 *S. 7th St., Phil'a, Pa.*

DeLange Exhibit No. 1.— , *Examiner.*

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

This agreement, made this third day of Jan'y, A. D. 1859, between the American Hard Rubber Company, owners of certain rights under patents granted to Nelson Goodyear May 6th, 1851, and reissued May 18th, 1858, and Bradley W. Franklin, of New York, agent for said company, of the first part, and Dr. Leo H. DeLange, of Bordentown, State of New Jersey, of the second part, witnesseth:

That the parties of the first part have agreed with the said DeLange to act as an agent for the sale, to dentists, in any of the cities or towns in the States of New York, Pennsylvania, and New Jersey office rights to manufacture plates and gums for artificial teeth, under said Goodyear patents, and also for the sale of heaters, flasks, and other apparatus and material necessary or useful in the performance of the said work.

565 And the parties of the first part agree to furnish to such parties as may be designated by the party of the second part licenses for office rights, and apparatus and material for working the same as they may be ordered by him:

Provided, that all such licenses shall conform to the printed copy hereto annexed.

And the parties of the first part further agree that they will make to the party of the second part a discount of twenty-five per cent. from their schedule prices to dentists on all rights, apparatus, and material sold by them, and which prices, until further notice, shall be as follows, viz:

For an iron heater, including office right	$50 00
" prepared gum, for vulcanizing, per pound	5 00
" flask and clamps, each	75
" sheet gutta-percha for temporary plates, per pound	2 00
" packing instruments, per doz	3 00

and all other material at reasonable prices.

And the party of the second part agrees to accept the said agency, and that he will exhibit the printed license hereto annexed to all who may purchase rights of him, as containing the exact terms and conditions of the license to be furnished by the party of the first part to all licensees, and that he will fully explain to the parties purchasing all the conditions of the said license.

Also, that he will sell no licenses with a heater, nor licenses alone, nor any other apparatus or material mentioned in the said schedule, for prices less than therein specified.

That he will sell no heater, gum, or other material, to any person not holding a license under the party of the first part.

That he will purchase all the heaters, flasks, gum, and other apparatus he may sell, of the parties of the first part, on the terms above mentioned.

That he will sell no licenses or heaters except for cash; and should he collect cash for any license at the time of taking an order for the same, that he will forward with such order the price of the heater and license to the party of the first part, less the amount of his commission; and if he shall not collect the price of the license and heater at the time

of taking the order, he shall in all cases make the condition with the purchaser that he is to pay cash on delivery of the said license and heater, and also the cost of transporting the same from the city of New York.

566 That he will in no way or manner countenance or encourage infringements upon the said patents of Nelson Goodyear, and that he will at all times acknowledge the validity of the same; that he will accept of the discount of twenty-five per cent. made as herein provided, together with such compensation as he may be able to obtain from parties to whom he may impart instruction in the art of applying the said patents to dentistry, as full compensation for his services as agent aforesaid.

This agreement may be terminated at any time by either party giving notice in writing to the other of their wish to that effect.

In witness whereof the parties to these presents have hereunto set their hands and seals the day and date above mentioned.

AMERICAN HARD RUBBER COMPANY,
[L. S.] By JOHN W. LEAVITT, *Secretary.*
BRADLY W. FRANKLIN, *Agent.*

De Lange Exhibit No. 2.— , *Examiner.*

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

This may certify that Dr. Leo H. DeLange is our duly authorized agent to solicit orders from dentists in any of the towns or cities in the States of New York, Pennsylvania, and New Jersey, for licenses to use the patents granted to Nelson Goodyear, May 6th, 1851, and reissued May 18th, 1858, in the manufacture and sale of plates and gums for artificial teeth; and also for the sale of heaters, flasks, prepared gum, and other material used in the manufacture of the said articles.

A copy of the licenses granted by us to dentists will be shown to purchasers by the said agent. No license will be valid unless signed by the secretary of the company, and Bradley W. Franklin, agent.

567 The prices for licenses and apparatus are as follows, viz:

For office right, including heater	$50 00
For flasks, with clamps, each	75
For prepared gum, per lb	5 00
For sheet gutta-percha, for impressions, per lb	2 00
For packing instruments, per doz	3 00

All orders taken by said agent, for licenses, or any of the above articles, will be forwarded immediately to the general agent, and answered without delay.

Terms will be invariably cash when the order is given, or on delivery of the articles ordered.

Expense of transportation to be in all cases borne by the purchaser.

AMERICAN HARD RUBBER COMPANY,
[L. S.] By JOHN W. LEAVITT, *Secretary.*
BRADLEY W. FRANKLIN, *Agent.*

De Lange Exhibit No. 3.— Examiner.

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

Whereas, letters patent of the United States were granted unto Nelson Goodyear, bearing date the 6th day of May, 1851, for an improvement in the manufacture of India-rubber and allied gums;

And whereas, the said letters patent were surrendered on account of a defective and insufficient specification, by Henry B. Goodyear, as administrator of the said Nelson Goodyear, deceased, and thereupon two new letters patent were granted for different parts of the said invention, for the residue of the unexpired term for which the original let-
568 ters patent were granted; one of the said new patents being for the new product, manufacture, or substance, known as the hard compound or vulcanized caoutchouc, or India rubber, and allied gums; and the other, for the improved process for producing the said product or substance, both of which said new letters patent bear date the 18th day of May, 1858;

And whereas, the American Hard Rubber Co. are the owners by assignment of the right, under the before recited letters patent, of working the said process, and producing, applying, and vending the said substance, as applied to dental purposes;

And whereas, L. H. De Lange, of Bordentown, county of Burlington, and State of New Jersey, is desirous of acquiring the right, privilege, or license of working the said process, and using the said substance for artificial gums or plates for artificial teeth, in his own business as a dentist, and to practice the same in the said Bordentown, of Bordentown, and nowhere else:

Now this indenture witnesseth, that for and in consideration of one dollar, lawful money of the United States, the receipt whereof is acknowledged, and the faithful performance by the said De Lange of the conditions hereinafter specified, we have bargained, sold, and conveyed, and by these presents do bargain, sell, and convey, unto the said De Lange, a right, privilege, or license, under the two before-recited letters patent, to work the said process, for the production of artificial gums, or plates for artificial teeth, and for no other purpose, and to vend and use the same, within the said town of Bordentown, and nowhere else, during the residue of the term for which the said letters patent are granted; the said right or license being granted upon the following conditions, and to cease, and to become of no force or effect, in the event of the failure to comply with any one or all the conditions hereinafter specified.

First. That the said right, privilege, or license, shall not be assigned, sold, or transferred, or otherwise disposed of, in any manner, without the written consent of the American Hard Rubber Co.

Second. That the said De Lange shall not permit any one in his employ, or under his control, to practice the said invention, or vend, or otherwise dispose of the said substance, except for the business of the said De Lange, and for the purposes, and within the limits herein specified.

Third. That the said De Lange, by himself, or his agents, or servants, shall not practice the said invention, or vend, or use the
569 said substance, except in his own business, and for his own office patients, and within the limits of the said town.

Fourth. That the said De Lange shall, at all times, admit the validity of the said patents, and shall keep a true and faithful account of all and every gum-plate, or other piece vulcanized by him, or for him, whether the same is made of india-rubber, gutta-percha, or other vulcanizable gum or gums, and used, or sold by him, in his said business, with the number of teeth contained in each piece thus vulcanized, and shall render quarterly, under oath, viz, on or before the 10th day of each of the months of January, April, July, and October, of each and every year during the existence of the said patent, a true and faithful account thereof, which he shall transmit by mail to the said American Hard Rubber Co., or their duly authorized agent at New York, and shall, on or before the 15th of each of the months in which the said accounts are rendered, forward by express to the said co., or their duly authorized agent, fifty cents for each piece containing one, two, or three teeth only, and one dollar on each piece containing any number of teeth over three, vulcanized by or for him, according to the account thus rendered.

Fifth. All improvements made by the said De Lange in the compounds or mixtures of gum, used for vulcanizing, or in the process or method of working or vulcanizing the same, shall be for the benefit of the said American Hard Rubber Co. and their licensees, as well as for that of the said De Lange.

Sixth. This license shall not be valid, unless countersigned by Bradley W. Franklin, agent.

In witness whereof the American Hard Rubber Co. have caused their secretary to sign these presents, and affix their seals thereto, on this 19th day of Feb'y, A. D. 1859.

[L. S.] AMERICAN HARD RUBBER COMPANY,
By JOHN W. LEAVITT, *Secretary.*
BRADLY W. FRANKLIN, *Agent.*

570 *De Lange Exhibit No.* 4.— *Examiner.*

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

BORDENTOWN, N. J., *Jan.*, 1859.

DOCTOR :

DEAR SIR: Having been appointed agent of the American Hard Rubber Company, for the States of New York, New Jersey, and Pennsylvania, to dispose of rights, apparatus, and material, and give instruction in the use of Goodyear's Patent Vulcanite Base, for artificial teeth, I shall be pleased to receive orders from you.

Should you desire to give the article a trial before entering more fully into the use of it, the following directions are all that is necessary.

Cover a plaster cast with tin-foil, then cover the foil with wax, or crude gutta-percha to the desired thickness (say one-sixteenth of an inch); set up your teeth according to the articulation; then build up with wax against the teeth, and wherever you require a fullness, take care to have the rivets of the teeth bent at right angles, inclining downwards so as to form almost a hook; when complete, send it to me and it will receive proper attention. When sent from a distance (which can be done by mail or express), set the cutting-edges of the teeth in plaster, to insure their safety, and the casts will be returned the day following.

Hoping to hear from you, I am
Respectfully, yours,

LEO H. DE LANGE.

Teeth for the vulcanizing process, without rivets, and in sections of two or more teeth; also crude gutta percha for taking impressions, and tools for finishing vulcanized work, furnished at moderate prices.

NOTICE TO THE DENTAL PROFESSION.

Various parties in the United States having claimed the right to manufacture from gutta-percha and other gums the hard material patented to Nelson Goodyear on the 6th day of May, A. D. 1851, which patent was reissued on the 18th day of May, A. D. 1858:

571 Notice is hereby given that the said patents cover the manufacture of the said material from india-rubber, gutta percha, and all other vulcanizable gums, and that all persons using the said patented process or material without license from me or those holding licenses under me are liable for damages, and will be prosecuted to the full extent of the law.

The exclusive right to use the said patents in the manufacture of plates and gums for artificial teeth in the city of New York and vicinity has been sold to the American Hard Rubber Co. and Dr. C. S. Putnam, of New York, and the right for the remainder of the United States and territories is owned exclusively by the American Hard Rubber Co. Suits have already been commenced against L. E. Christopher & Co., of No. 5 Bond street, N. Y., for infringements upon the said patents in the manufacture of what they term the coralite base for artificial teeth. And all other parties who may persist in violating the said patents, after receiving this notice, will be subjected to similar proceedings.

H. B. GOODYEAR,
Administrator of the estate of Nelson Goodyear, deceased.

GOODYEAR'S PATENT VULCANITE.

Four years' extensive use by the public has fully established the superiority of this article over all other known materials as a base for artificial teeth; and the constantly increasing demand for it from dentists in all parts of the country has induced the owners of the patent to afford corresponding facilities for its use. They are now prepared to sell office-rights, furnish the prepared material and suitable apparatus for vulcanizing, and to give instructions in the art of using the same, on reasonable terms.

For the accommodation of dentists in New Jersey and vicinity, a vulcanizing apparatus has been established in Bordentown, under the charge of Dr. Leo. H. De Lange, where the work will be faithfully done at the following rates:

For vulcanizing pieces containing one or two teeth	$2 00
" " " three, four, five, or six teeth	3 00
" " " over six teeth	4 00
For furnishing gum and packing each piece	1 00
For finishing and polishing " "	2 00

☞Prepared material for vulcanizing, $5 per pound. Vulcanizing flasks at reduced prices.

572 Complete apparatus, with office rights, full instructions how to use the same, and the right to use Goodyear's Patent Plaster Moulds (which are indispensable to this process), will be furnished by Dr. Leo H. De Lange, dentist, Bordentown, New Jersey.

The particular attention of the profession is invited to the above card, from Mr. Goodyear, published by the

AMERICAN HARD RUBBER COMPANY,
No. 63 Maiden Lane, New York.

PHILADELPHIA, *December 20th*, 1858.

I have used for several months the vulcanite base for sets of teeth with universal satisfaction; it is worn with more ease and comfort than any metal plate, and adheres more firmly to the mouth. I have used it with entire success in several cases where gold was inadmissible on account of its metallic taste; it has almost entirely taken the place of gold plates in my practice.

EDWARD TOWNSEND,
Dentist, No. 526 North 4th Street.

We, the undersigned, having used extensively in our practice "Goodyear's Patent Vulcanite," take pleasure in recommending it to the profession as in every respect equal and in many respects superior to gold as a base for artificial teeth.

E. D. ROOT,
13 *Bond Street.*
H. C. GROUT,
3 *Bond Street.*
T. C. BANK,
234 *West 8th Street.*
D. STEINBERG,
47 *Bond Street.*

NEW YORK, *December 18th*, 1858.

And now, by consent of counsel, an adjournment was had until Saturday, a. m., November 15th, 1873, at 10 o'clock.

573 And now, Saturday, November 15th, 10 o'clock a. m., parties in interest reappeared pursuant to adjournment.

Defendant's counsel produces, and offers in evidence, a volume, entitled The New York Dental Recorder, devoted to the theory and practice of surgical, medical, and mechanical dentistry; edited by C. C. Allen, M. D., dentist. Volume III. New York. Printed by E. N. Grossman, 12 Spruce street, 1849; and refers to page 80 of said printed publication, being a part of the number of said journal for January, 1849; and the same is marked Defendant's Exhibit No. 57.

(Objected to as not properly proved.)

EDWARD S. RENWICK, a witness produced on the part of defendant, having been duly sworn, deposes and says, in answer to the interrogatories propounded to him by the counsel for defendant, as follows:

Q. 1. State your age, residence, and occupation.

A. I am fifty years of age; reside at Millburn, N. J., my place of business being the city of New York; I am occupied principally in acting as expert in the trials of patent cases, and in soliciting patents.

Q. 2. State, generally, the extent of your experience in examining questions of substantial identity and difference, both in mechanisms and in processes involved in litigation, or otherwise.

A. I have been engaged for upwards of twenty-four years in my present occupation. During that time I have had to make numerous investigations into the histories of inventions as found recorded in books and in the records of patents, both American and foreign, for the purpose of ascertaining the novelty or want of novelty of inventions of many different descriptions, including machinery and processes. I have also been frequently called upon to compare machines and processes, for the purpose of ascertaining their similarities and differences as com-

pared with those previously known. I have also been frequently called upon to testify as to the similarities and differences of machines and processes in patent causes in the United States courts, and for a number of years back have been called upon for this purpose many times every year.

(Defendant's counsel put in evidence a certified copy, from the
574 records of the Patent Office, of letters patent granted John A. Cummings, June 7th, 1864, No. 43009, for improvement in artificial gums and palates; and the same is marked Defendant's Exhibit No. 58. Also, a certified copy, from the records of the Patent Office, of the reissued letters patent granted the Dental Vulcanite Company, March 21st, 1865, No. 1904, for improvement in artificial gums and palates; and the same is marked Defendant's Exhibit No. 59.)

Q. 3. Have you examined the specifications and drawings of the letters patent No. 43009 (Defendant's Exhibit No. 58), and of the reissue No. 1904 (Defendant's Exhibit No. 59), and do you understand those descriptions and representations?

A. I have examined certified Patent Office copies of the specifications and drawings of both the letters patent referred to in the question, and I believe that I understand the descriptions and representations contained therein.

Q. 4. How many processes are described in the reissue No. 1904?

A. There are two processes described in the said reissue No. 1904.

Q. 5. What are they, and in what does each consist?

A. The first process is a process for making a mould, the second process is a process for making a plate of vulcanite or hard rubber, as it is commonly called.

The process for making the mould consists of several operations, which are: First, the making of a wax or plaster impression of the mouth; second, the making of a plaster cast from the wax impression, which plaster cast is a fac-simile, in plaster, of the part of the mouth to which the wax was applied; third, the making of a model, upon this plaster cast, of the dental plate which is required; such model being formed of wax, with teeth inserted in it; fourth, the making of a plaster mould upon the said model while it is supported upon the plaster cast on which it was modeled; fifth, the removal of the wax model, so that the mould consists of two parts, which are the plaster cast made from the wax impression, and the matrix or hollow division of the mould containing the teeth, and having a cavity in it surrounding the ends of the teeth, of the form of the dental plate to be produced.

The process for making the plate consists of two operations, which are, the moulding of the material into the desired shape while it is in a plastic condition; second, the vulcanization of the material, or,
575 in other words, the subjection of it to heat of the requisite temperature to produce the change commonly called vulcanization, whereby the material becomes hardened.

Q. 6. State whether or not you find the mode of making the mould described in the reissue No. 1904 described or suggested or indicated in the original patent No. 43009; and give your reasons for such opinion as you may express.

A. I do not find in the specification and drawings of the original patent, No. 43009, the mode of making the mould which is described in reissue No. 1904, or any suggestion or indication of the same. My reason for this opinion is as follows:

The mode of making the mould described in said reissue No. 1904 requires, among other things, the formation of a model of wax with the

teeth in it, and the removal of the said wax model, leaving the teeth in the mould projecting into the cavity thereof, so that the dental plate which is subsequently made has its final form imparted to it by the surfaces of the mould. Now in the original patent No. 43009 a very different mode of operation is described: namely, that the rubber itself is moulded to fit the shape of the mouth (in what manner it is not stated), and that the teeth are imbedded in this rubber while it is soft and pliable; instead, as described in the said reissue, of the teeth constituting a part of the mould to which the rubber is applied, in order that its exterior form may be imparted to it by the form of the mould. Moreover, in the original patent No. 43009 there is no description or suggestion of making a matrix of plaster from a model, which matrix, when the model is removed, shall hold the teeth in the proper positions for the rubber to be applied to them.

Q. 7. Please examine the following (defendant's) exhibits, to wit:

No. 9. Clayton's Patent No. 12156, dated January 2d, 1855.

No. 11. Blandy's Patent No. 16708, dated March 3d, 1857.

No. 18. Macintosh's English Patent No. 2790, dated December 8th, 1859.

No. 19. Dewar's English Patent No. 4, dated January 2d, 1860.

No. 20. Cartwright's English Patent No. 1549, dated June 26th, 1860.

The specifications of Robert Haering filed in the Patent Office March 25th, 1856, being part of Defendant's Exhibit No. 22, the drawing pertaining to the said specifications of Robert Haering being Defendant's Exhibit No. 21.

576 No. 38. Being an article in the American Journal of Dental Science, Vol. I, new series, October, 1850, pages 1 to 8 inclusive.

No. 46. Being articles in The Vulcanite, Vol. I, pp. 68, 70, pp. 130, 132, pp. 178 to 180, and Vol. II, pp. 40 to 42.

No. 47. Being articles in Harris's Principles and Practice of Dental Surgery, 5th edition, 1853, Chap. XIX, pp. 736 to 740; and

No. 54. Being article from the Revue Odontotechnique, and state whether or not you find in said exhibits any description of the process of forming a mould which is the same as that described in said reissue No. 1904.

A. I have examined each of the exhibits referred to in the question, and assuming that Nos. 21 and 22 constitute in substance one exhibit, I find that each one of them contains a description of a process for forming a mould for a dental plate, which is substantially the same as the description for forming the mould contained in said reissue No. 1904. Some of the said exhibits describe the said process with greater minuteness than is described in the said reissue, and others with less minuteness.

Q. 8. State whether or not the mould described in said reissue No. 1904 is described in said exhibits recited in the last question.

A. The said mould is described in each of said exhibits, assuming that Nos. 21 and 22 constitute in substance one exhibit.

(Defendant's counsel puts in evidence a certified copy, from the United States Patent Office, of the provisional specification and of the specification of the English letters patent to Charles Goodyear, jr., for the invention of improvements in the plates of artificial teeth, sealed May 8th, 1855, and dated March 14th, 1855, No. 577. Also a certified copy from the United States Patent Office of English letters patent No. 13542, to Alfred Vincent Newton, enrolled September 4th, 1851, and dated March 4th, 1851; and the same are marked respectively Defendant's Exhibits Nos. 60 and 61.)

Q. 9. Examine Defendant's Exhibit No. 60, and state whether or not the process of making the mould described in reissue No. 1904 is described in said Exhibit No. 60; and also, whether or not the mould described in said reissue No. 1904 is described in said exhibit.

A. The said Exhibit No. 60 describes a mode of making a mould for a dental plate which is substantially the same as the mould de-
577 scribed in said reissue No. 1904. The said Exhibit No. 60 also describes a mould for a dental plate which is substantially the same as the mould described in the said reissue No. 1904.

Q. 10. Please examine the following (defendant's) exhibits, to wit:

No. 5. Being the letters patent granted to Charles Goodyear, assignee of Charles Goodyear and Robert Haering, No. 9668, dated April 12th, 1853; the specification of said Goodyear and Haering filed in the matter of the application for said letters patent being part of Defendant's Exhibit No. 4.

No. 61. Being Newton's English patent No. 13542, dated March 14th, 1851.

No. 60. Being Goodyear's English patent No. 577, dated March 14th, 1855.

No. 14. Being Child's English patent No. 193, dated January 21st, 1859.

No. 16. Being Lawrence's English patent No. 1842, dated August 9th, 1859.

No. 17. Being Child's English patent No. 2295, dated October 8th, 1859.

No. 20. Being Cartwright's English patent No. 1549, dated June 26th, 1860.

No. 1. Being Nelson Goodyear's patent No. 8075, dated May 6th, 1851.

No. 2. Being reissue No. 556 of said letters patent No. 8075.

No. 3. Being reissue No. 557 of said letters patent No. 8075.

No. 19. Being Dewar's English patent No. 4, dated January 2d, 1860.

Haering's specification, filed March 25th, 1856, being part of Defendant's Exhibit No. 22.

No. 21. Being the drawing pertaining to said Haering's specification, and No. 54 being the article in the Revue Odontotechnique, November, 1860, pp. 297–300, and state whether or not you find described in said exhibits substantially the same process as is described in said reissue No. 1904, for the purpose of making the vulcanite dental plate.

A. I have examined each of the exhibits referred to in the question, and considering Exhibits Nos. 21 and 22 as constituting one document, I find that each describes a process which is substantially the same as that described in the said reissue No. 1904, for the purpose of making a dental plate of vulcanite, each of the said exhibits, except Exhibit
578 21 considered separately from Exhibit 22, describing the process consisting of two operations, which are the moulding of the material to the desired form, while in a plastic state, and the vulcanization of it by the application of heat of the requisite intensity. Some of the said exhibits describe the process as applicable to the production of a variety of articles, among which a dental plate is not mentioned. These exhibits are Nos. 5, 4, 61, 1, 2, and 3.

The other exhibits describe the process as applied to the production of dental plates of vulcanite. These exhibits are Nos. 60, 14, 16, 17, 20, 19, 22, and 54.

Q. 11. Examine the Defendant's Exhibit No. 46, being the articles in The Vulcanite, Vol. I, pp. 68–70, pp. 130–132, pp. 178–180, and Vol. II, pp. 40–42, and state whether or not you find described, in said exhibit,

substantially the same process as is described in said reissue No. 1904, for the purpose of making the vulcanite dental plate.

A. I have examined each of said articles, and I find that each of them describes the same process as is described in the said reissue No. 1904, for the purpose of making a dental vulcanite plate; each of the said articles describing a process consisting of two operations, which are, the moulding of the material to the required form while it is in a plastic condition, and the vulcanization of the moulded material by the application of heat of the requisite intensity. The said articles describe the said process as applicable to the production of dental vulcanite plates.

Q. 12. Examine the following (defendant's) exhibits, to wit:

No. 14. Being Childs's English patent No. 193, dated January 21st, 1859.

No. 15. Being Ash's English patent No. 1421, dated June 11th, 1859.

No. 17. Being Childs's English patent No. 2295, dated October 8th, 1859.

No. 19. Being Dewar's English patent No. 4, dated January 2d, 1860.

No. 20. Being Cartwright's English patent No. 1549, dated June 26th, 1860.

No. 60. Being Goodyear's English patent No. 577, dated March 14th, 1855.

No. 16. Being Lawrence's English patent No. 1842, dated August 9th, 1859.

579 No. 46. Being the articles contained in The Vulcanite, vol. I, pp. 68–70, 130–132, 178–180, and vol. II, pp. 40–42.

No. 54. Being the articles in the Revue Odontotechnique, pp. 297–300. The specification and drawing of Robert Haering's application of 1856, being Defendant's Exhibit No. 21, and a part of Defendant's Exhibit No. 22; and state whether they do or do not describe a vulcanite dental plate such as is recited in said reissue No. 1904.

A. I have examined each of the said exhibits, and I find that each describes in substance a dental vulcanite plate which is substantially the same as that recited in the said reissue No. 1904. In two of the said exhibits, Nos. 15 and 17, the description is general. In the remaining exhibits the description is specific and particular.

Q. 13. Examine the following (defendant's) exhibits, to wit:

Nos. 38 and 39. Being the articles in the American Journal of Dental Science, vol. I, new series, October, 1850, pp. 1 to 12 inclusive.

No. 40. Being the article in the Dental News Letter, vol. IV, No. 2, January, 1851, pp. 59, 63.

No. 47. Being the article from Harris's Principles and Practice of Dental Surgery, 5th edition, 1853, chap. XIX, pp. 736, 740.

No. 55. Being the article from the New York Dental Recorder, vol. IV, September, 1850, pp. 286–288.

No. 56. Being the article from the Dental Register of the West, vol. IV, October, 1850, pp. 38–40.

No. 42. Being the article from the American Journal of Dental Science, vol. IV, new series, Jan., 1854, pp. 223–226.

No. 13. Being Schoof's English patent No. 893, dated April 21st, 1855.

No. 52. Being the article from Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences, 1851, p. 126.

No. 9. Being Clayton's patent, No. 12156, dated January 2, 1855.

No. 12. Being English letters patent to Edwin Thomas Truman, No. 12241, dated August 15, 1848, and state whether they do or do not describe dental plates which are the same or differ in any respect from the

vulcanite dental plate recited in said reissue No. 1904; and, if yea, in what respects they differ therefrom or are similar thereto.

A. I have examined the exhibits referred to in the question. I find that Exhibits Nos. 38, 40, 47, 55, and 56 each described a
580 dental plate made according to the Hawes system, having the same mechanical structure as the vulcanite dental plate described in said reissue No. 1904; the plate in each case having teeth with pin fastenings, and having the foundation which comes in contact with the jaw of the patient, and the parts which surround and imbed the inner ends of the teeth and their fastenings composed of the same material in one piece. The said dental plates described in said exhibits differ from the vulcanite dental plate described in said reissue No. 1904 in the respect that the material which forms the foundation and incloses the inner ends of the teeth and their fastenings is tin, while the corresponding material of the dental plate described in said reissue is vulcanite, or hard rubber, as it is commonly called.

Exhibit 39 describes several dental plates; the first one of these is substantially the same in its mechanical structure with the vulcanite dental plate described in said reissue No. 1904, the said plate of said exhibit having teeth with a continuous wire fastening, and having the foundation which comes in contact with the jaw of the patient, and the parts which surround and imbed the inner ends of the teeth and their fastenings, composed of the same material in one piece. The said plate of said exhibit differs from that described in the said reissue in the respect that the material which forms the foundation and imbeds the inner ends of the teeth and their fastenings is tin, while the corresponding material of the dental plate described in said reissue is vulcanite. The other plates described in said Exhibit No. 39 are like that described in the said reissue No. 1904, in having teeth, a foundation to rest upon the jaw, and material surrounding and imbedding the inner ends of the teeth and their fastenings; but they differ from the plate recited in said reissue in two respects, namely, first, that the foundation resting on the jaw is not of the same material as that which surrounds and imbeds the teeth and their fastenings, whereas in the dental plate recited in said reissue the said foundation and the parts surrounding and imbedding the teeth and their fastenings are of the same material and in one piece. The second difference is that the foundation and portion surrounding and imbedding the inner ends of the teeth and their fastenings are of metals, whereas in the dental plate described in said reissue the material of the corresponding parts is vulcanite.

The dental plates described in Exhibit No. 42 are substantially the same in their mechanical structure with the vulcanite dental plate
581 described in said reissue No. 1904, all of them having teeth with fastenings, and having the foundation which comes in contact with the jaw of the patient and the parts which surround and imbed the inner ends of the teeth composed of the same material in one piece. The dental plates described in said exhibit differ from the vulcanite dental plate described in said reissue in the respect that the material which composes the foundation that comes in contact with the jaw of the patient and the parts which surround and imbed the inner ends of the teeth and their fastenings is, for the former, a compound of gutta-percha, unvulcanized, and for the latter, vulcanite. In making this statement I have taken into consideration the fact that the said exhibit does not describe pin fastenings for the teeth, but it does describe means of fastening which are mechanical equivalents for pin fastenings for the purpose of holding teeth in the material in which their inner ends are imbedded,

and I consider that the difference in the former fastening is immaterial, for the reason that if a person should secure teeth in a vulcanite plate in the same manner as the said exhibit describes in reference to a gutta-percha plate, the vulcanite plate, with teeth thereby produced, would be substantially the same as that described in the said reissue No. 1904.

Exhibit No. 12 describes two descriptions of dental plates, both having a gutta-percha foundation; the one which is first described is like the vulcanite dental plate described in the patent in the respect that the body of the plate is of one piece of material, and that the teeth are fastened to that body. The first plate of said exhibit differs from that described in the said reissue in the respect that the former is gilded all over, including the sockets for the teeth, while no gilding of the plate is described in said reissue; the former also differs from the latter in the respect that the teeth are secured in their sockets by cement after they have been taken out, in order that the gilding of the sockets may be effected, whereas no cement is described or required for fastening the teeth of the plate of said reissue. The first plate of said exhibit also differs from that described in the said reissue in the respect that the material of the body of the former is gutta-percha, which is not vulcanized, while the material of the body of the latter is vulcanite. After the description of the gilded plate in the said Exhibit No. 12, there follows the statement: "It is not essential to making artificial teeth and gums, according to my invention, that the gutta-percha used should be coated with gold." This language, when taken in connection
582 with the preceding description of the exhibit, amounts in my opinion to a description of a completed dental plate having teeth and having the foundation which comes in contact with the jaw of the patient, and the portions which surround and imbed the inner ends of the teeth and their fastenings, of one piece of gutta-percha, from which the teeth have not been removed for the purpose of gilding their sockets, and this said second plate is substantially the same in its mechanical structure as the vulcanite dental plate described in said reissue No. 1904, each having teeth, and each having the foundation which comes in contact with the jaw of the patient, and the parts which surround and imbed the inner ends of the teeth and their fastenings, composed of one material in one piece. The said second plate of said exhibit differs from the dental plate described in the said reissue in the respect that the material which forms the foundation and the parts which surround and imbed the inner ends of the teeth and their fastenings is gutta-percha, unvulcanized, whereas the corresponding material of the plate described in said reissue is vulcanite. In making the above statement I have taken into consideration the fact that the fastenings for the teeth described in said Exhibit No. 12 are pins which extend lengthwise of the teeth, whereas the corresponding fastenings of said reissue are pins which extend crosswise of the teeth, but I do not consider this difference material, because if a person should construct a vulcanite dental plate with longitudinal pin-fastenings for the teeth, I have no doubt that such plate would be substantially the same vulcanite dental plate as that described in the said reissue.

Exhibit No. 13 describes dental plates having the foundation and the portions which surround the lower ends of the teeth and their fastenings of gutta-percha, or a mixture of gutta-percha and other gums. The dental plates thus described have substantially the same mechanical structure as the vulcanite dental plate described in the said reissue No. 1904, the said dental plates of the exhibit having teeth, and having the foundation which comes in contact with the jaw of the patient, and the

portions which surround and imbed the inner ends of the teeth and their fastenings, of the same material, in one piece. The said dental plates of the exhibit differ from that described in the said reissue in the respect that in the former the material of the foundation and portions surrounding the inner ends of the teeth are of gutta-percha, or of a compound of it not vulcanized, whereas the corresponding material
583 of the dental plate described in the said reissue is vulcanite. In forming the above opinion I have taken into consideration the fact that the fastenings for the teeth described in the said reissue are pins, while the patent describes fastenings of "platina tenons, screw-pivots, or gold plate, or gold wire"; but I do not regard this difference in the form of the fastenings as material, because they are described in the said exhibits as being covered by the material of the dental plate, so that they are imbedded in it as the pins described in the said reissue are, and because the use of the same fastenings (described in the said exhibit) in a vulcanite dental plate would not make it when completed substantially different from that described in the said reissue.

Exhibit No. 52 describes a dental plate composed of gutta-percha. The said dental plate is substantially the same in mechanical structure with the vulcanite dental plate described in the said reissue No. 1904, each having teeth, and having the foundation which comes in contact with the jaw of the patient and the parts which surround and imbed the inner ends of the teeth, and their fastenings, of one material in one piece. The dental plate of said exhibit differs from that described in the said reissue, in the respect that in the former the material which forms the foundation and the portions which surround the inner ends of the teeth is gutta-percha, whereas the corresponding material of the dental plate described in the reissue is vulcanite. The fastenings mentioned in the said exhibit are designated as "crampons métalliques," which correspond more nearly with what we would call metal cramps, or pieces of metal having their ends bent, than what is generally understood by the word "staples," which is used in the translation. Such cramps are substantially the same kind of fastenings as the platina pins generally found in artificial teeth are when the ends of such pins are bent.

Q. 14. State whether in your opinion there is or is not any necessary connection between the process of making the mould described in said reissue No. 1904, and the process of making the vulcanite plate described in that reissue; and give your reasons for such opinion as you may express, including any illustrations that occur to you.

A. In my opinion there is no necessary connection between the process for making the said dental plate and the process for making the said mould, and for several reasons. The mould is an implement used
584 in the process of making the plate, and if the process of making that implement constitutes, by any mode of reasoning, a part of the process of making the dental plate, then the various processes required for making other implements which are just as necessary as the mould for carrying out the process of making the plate, must by the same reasoning be made to constitute parts of the process of making the dental plate; and, therefore, the process of making the vulcanizing apparatus which is required to heat the plate, and the process of making the thermometer by which the intensity of the heat is determined, would, in such event, constitute parts of the process of making the vulcanite plate, which, in my opinion, would be an absurd proposition. Again, the process of making the mould is not, in my opinion, necessarily connected with the process of making the dental plate described in the said

reissue, because when the mould is completed and the process for making it ended, the mould may be used for other purposes, as, for example, for making a tin dental plate, such as is described by Hawes. Moreover, if the vulcanite plate described in the patent were formed into shape by some other implements than the mould described in the said reissue, and was vulcanized without the use of the mould described in the said reissue, the plate when completed would still be substantially the same vulcanite dental plate as is described in the said patent, and the process for making the plate described by me in answer to question 5 would be the same, although the process for making the mould was not used. A familiar illustration of what I have said is found in the manufacture of yarn; thus, wool is manufactured into yarn by a process called spinning, which consists in laying the fibres of the wool approximately parallel with each other, in the form of a loose band or sliver, and then twisting the said fibres. Now, wool has been spun by the apparatus known as the distaff and spindle, the apparatus known as the common spinning wheel, and the power apparatus known as the mule. Each of the apparatuses required different processes for their formation, yet the process of spinning effected by their use is the same; but if by any system of reasoning it should be held that the process of spinning comprehended, as an essential characteristic of it, the process by which the apparatus or implement used was made, then it would follow that the process of spinning was substantially different for each of the three apparatuses I have above mentioned, because different mechanical processes are required in the manufacture of those different apparatuses.

585 Q. 15. Assume that the process of making the vulcanite dental plate described in the reissue No. 1904 includes both the process of making the mould and the process of making the plate; and then state whether or not such assumed process is described in the original letters patent No. 43009, and give your reasons for the opinion you may express.

A. Under the assumption contained in the question, the said assumed process is not described in the said original patent No. 43009, for the reason that the process of making the mould described in the said reissue is not described in the original patent. Thus in the reissue the matrix of the mould is formed upon a model of wax which is subsequently removed, leaving the teeth fixed in the matrix and constituting a part of the mould by which the plastic material has its form imparted to it; whereas in the original patent the plastic material is moulded into shape without any matrix, and the teeth are inserted in it after it is moulded; and there is no description whatever of any matrix or of any mode of making one.

Q. 16. Examine the model now shown you, being defendant's Exhibit duplicate Cumming's model, and state if you have compared said exhibit with the original model produced by the witness Edward C. Ford, from the Patent Office; and if yea, how far this duplicate agrees with or differs from said Patent Office model.

A. I compared the said duplicate Cummings model with the said original model from the Patent Office in the possession of Mr. Edward C. Ford, and found that the two were like each other in all respects except the following: the color of the vulcanite of the said duplicate is brighter than that of the said original model, which was of a darker red brown mahogany color. The left-hand rear molar tooth in the said duplicate is loose as it was in the said original model; but the platina pins at the inner side of that molar tooth are in the duplicate more un-

covered than they were in the said original. In the said original I noticed that but two of the platina pins at the left-hand side of the interior were exposed to view, while in the said duplicate the ends of three are exposed to view. I noticed also that the finish of the under side of the roof of the plate in the vicinity of the jaw is a little smoother in the said duplicate than it was in the said original model. These are all the differences that I noticed.

586 Cross-examined by complainant's counsel:

X Q. 17. Does not the vulcanite dental plate possess qualities and exhibit peculiarities both in the manufacture itself, when complete, and in the means by which it is made, which clearly distinguish it from any other dental plate whatever of which you have any knowledge?

(Objected to as not stating by what means the plate is made, which is contemplated in the question.)

A. The vulcanite dental plate has, so far as I know, a peculiarity of composition which is not possessed by any other dental plate of which I have knowledge, it being a composition of india-rubber or other vulcanizable gum with sulphur, which has been changed by the action of heat. So far as its manufacture is concerned, I may state that I do not know any other dental plate which has gone through the process of vulcanizing or subjecting to heat in a close vessel at a specific temperature, although other dental plates are subjected to heat in the process of manufacture; as respects qualities, I do not know that I am sufficiently informed to speak of the matter with certainty, as I have never worn a dental plate myself of any material, am not a dentist, and have not had the opportunity of observing the action of dental plates in the mouths of patients; but I may state that I am not aware that a vulcanite dental plate possesses any property in kind which is not possessed by other dental plates of which I have seen descriptions, although it possesses some of those properties in a greater degree than other plates of which I have seen descriptions.

X Q. 18. Do you think experience in its use would be necessary in order to enable you to answer as to the qualities of a vulcanite dental plate?

A. I think that experience in its use, or the opportunities of observing the action of vulcanite dental plates in the mouths of patients, is required to enable me to answer properly as to the useful qualities of a vulcanite dental plate. The abstract qualities of the material of which the plate is composed (vulcanite) can be judged of without the experience in the use or action of the dental plates.

X Q. 19. Has not the vulcanite dental plate when ready for use (by which I mean the thing composed of teeth and base) peculiarities beyond the mere peculiarity of the vulcanite base?

A. It has a peculiarity of mechanical structure, namely, that the foundation which is in contact with the jaw of the patient and
587 the portions which surround and imbed the inner ends of the teeth and their fastenings are (when the plate is completed) of the same material in one piece. It has a color which differs from that of metals, but I have not regarded this as important, because some of the descriptions of gutta-percha plates which I have seen speak of the use of coloring matter, and the color of vulcanite might be readily imitated in gutta-percha. It also has a peculiarity of form, its form being adapted to the jaw to which it is to be fitted. It also has the peculiarity of containing teeth and fastenings.

X Q. 20. In 1852 was it known, so far as you are informed, that the

article now known as vulcanite could be so manufactured as to resemble in color the natural gum?

A. I don't know that I have ever seen vulcanite which resembled the color of the natural gum other than in the respect that both are red, as all the specimens of vulcanite that I have seen of a red color are much darker than the color of the natural gum. As respects the date when a red color was imparted to vulcanite, I have no distinct recollection. I have an indistinct impression of some early English patent, which described the use of sulphuret of antimony in the manufacture of hard rubber, the effect of which was to impart a red color to the compound, as I know by having on one occasion made some of the compound with that material, but I have no recollection whether that patent was before or after 1853. As I was not personally familiar with the manufacture of vulcanite as early as 1852, I have no knowledge on the subject prior to that date, except such as is derived from publications, and I do not recollect at the present time any publication prior to that date which states distinctly that vulcanite could be so colored in its manufacture as to resemble in color the natural gum, although there are general statements in respect to coloring it.

X Q. 21. Is not the vulcanite dental plate characterized by this peculiarity, that the teeth adhere to the base with a great adhesion independently of the metallic fastenings or pins?

A. There is some adhesion between the teeth and the material of the plate, but I do not consider that it can be very great practically, as pin fastenings are, so far as I know, universally employed to secure the teeth in their positions, which indicates to my mind that the adhesion between the material and the teeth cannot practically be very great.

X Q. 22. Does not that adhesion produce another valuable re-
588 sult, namely, the exclusion of the liquids in the mouth from the joint between the teeth and the base?

A. The close contact of the material of the base with the teeth tends to prevent the entrance of the secretions of the mouth between the two, whether there be adhesion or not. Now, in the vulcanite plates which I have observed, the glazed portions of the teeth are partially imbedded in the vulcanite, and at these places the adhesion is extremely slight, so that the prevention of the entrance of the secretions of the mouth is due rather to the close contact of the glazed surfaces of the teeth and the material of the base than to the adhesion between the two.

X Q. 23. Do you suppose that, under the operation of masticating, a water-tight joint could be preserved between those surfaces if it were not for the adhesion between them?

A. In the first place, I greatly doubt the fact whether a water-tight joint is preserved for an indefinite period between the surfaces of the teeth of a vulcanite dental plate and the surface of the material of the plate. As respects the preservation of a water-tight joint, I know by observation that it can be preserved for a long period under the action of mastication between metal surfaces and the surfaces of teeth, in which cases there is no more adhesion between the surfaces in contact than there is between the teeth of a vulcanite plate and the material of the plate; and therefore I do suppose that under the operation of mastication a water-tight joint could be preserved for a period of greater or less duration between those surfaces, even if there were no adhesion between them.

X Q. 24. Does not the fact of adhesion make that a better water-tight joint than it would be without it?

A. I don't believe it does—assuming that the contact be sufficiently

close to prevent the entrance of water, as it should be for good work.

X Q. 25. Do you think that the fact of adhesion impairs the quality of the joint?

A. Certainly not. I think that it does not affect the quality of the joint, assuming that the work is good, and the surfaces of the teeth are glazed where they come in contact with the material.

X Q. 26. Do you suppose that the thin vulcanite material which is formed around the teeth could be made to close a water-tight joint if it were not for adhesion? If so, tell the court how you would propose to do it.

589 A. I suppose that the vulcanite material which surrounds the lower ends of the teeth, when the plate is properly made, will make the joint between the surfaces of the teeth and the material water-tight until sufficient force is applied to move the two apart. As respects the mode of making the plate so as to have the joint water-tight, all that is necessary is to see that the teeth are perfectly clean at the time the vulcanite is applied to them, to press it while it is in a plastic state firmly in contact with the surfaces of the teeth, and to vulcanize it while it is held there under pressure, taking care that in the finishing of the plate sufficient force is not applied to move the teeth in their sockets.

X Q. 27. Do you suppose that the joints between the inside of the teeth and the vulcanite base could be kept water-tight in use if it was not for the adhesion between the base and the teeth?

A. I suppose that the joints at the place mentioned could be kept water-tight in use if it were not for the adhesion between the base and the teeth, until sufficient force was applied to move the teeth in their sockets. If, for example, a person should try to crack nuts with the teeth of vulcanite plates in their mouth, I think that the teeth would be sufficiently strained to admit water into the joints between the glazed surface and the material of the plates.

X Q. 28. Are not the distinctive peculiarities of a vulcanite dental plate, when complete and ready for use, such as that it could be easily distinguished by any person not an expert from any other dental plate whatever of which you have any knowledge or of which you have ever heard?

A. I think a person who is not an expert would readily distinguish a vulcanite dental plate from other dental plates of metal by the fact that it is of a different color, of lighter weight, and, being a bad conductor of heat, it would feel differently to the touch; but I think it would be practically impossible for a person who is not an expert to distinguish a vulcanite dental plate from a gutta-percha dental plate, except by trying it with a finger-nail or some other instrument, and noting that the vulcanite dental plate was harder than the gutta-percha dental plate.

X Q. 29. Do you think it would require an expert to use his finger-nails on the two things and thereby distinguish them and ascertain that they were not the same thing?

A. I think that if two plates were made in all respects alike, except that the material of the body of one was vulcanite, and the ma-
590 terial of the body of the other was gutta-percha, even an expert would have to use some means to determine that the two were made of different materials. The well-known difference in comparative hardness between unvulcanized gutta-percha and vulcanite would be the readiest foundation for ascertaining the difference, and an expert

might very conveniently use his finger-nail for testing the comparative hardness or resistance to penetration.

X Q. 30. Question repeated.

A. I thought that I had answered the previous question fully, but I may state further that if an expert did not use his finger-nail he would have to use some other means; and further that as the expert's finger-nail belongs to himself, I should think it would require the expert to use his own finger-nail.

X Q. 31. Do you mean to say that the difference between a vulcanite dental plate and a gutta-percha one is such that it would require the skill of an expert to distinguish them?

A. I mean precisely what I have stated in my previous answers, but I may state further that a person who is not what is technically termed an expert, but who had some knowledge of the comparative hardness of gutta-percha and vulcanite, would probably be able to distinguish dental plates made of the two different substances by a comparison of their respective hardness or impenetrability. If he had no previous knowledge of gutta-percha and vulcanite, I doubt if he would think there was any difference between the two that would lead him to think that they were made of different materials.

X Q. 32. Assume for the purposes of the question that an unskilled man had never heard the names gutta-percha and vulcanite, and had never seen the articles, and had two dental plates, one made of each material, put into his hands; do you suppose that after he had pressed them both with his finger-nail, the test you propose, or had held them both in his mouth for a few minutes, he would suppose them to be the same article or substantially the same?

A. I think that he would very naturally suppose them to be the same article or substantially the same, assuming that they were like in all other respects than in the material of which the plates were made; but he would notice the difference in comparative hardness, and would probably suppose that for some reason the material in one had been made harder than in the other.

591 X Q. 33. Do you think that delusion would continue when he ascertained that the gutta-percha plate at a temperature of 100° would become soft, and that the other would be insensible to a high degree of heat?

A. If the person who had the two plates should subject the two to a high degree of heat, and should ascertain that the gutta-percha plate softens, while the vulcanite plate remains hard, I think the presumption is that he would at first suppose rather that there was a difference in the modes in which the plate had been made than in the materials of which they were composed; and by continuing his experiments he would probably, in the end, come to the conclusion that the materials of which the two plates were composed were not the same, or else that some different process had been performed, which rendered the material of one plate less changeable by heat than the other; for, if he continued the experiments far enough, he would find that the vulcanite plate would soften by heat, so that, as respects the test by heat alone, the difference was one of degree rather than a difference in kind.

X Q. 34. Wouldn't he make the same discovery in reference to a gold plate, if he heated that far enough?

A. As respects the test by heat alone, he certainly would.

X Q. 35. Do you think that he would infer that the differences between gutta-percha and gold were therefore in degree and not in kind?

A. So far as respects resistance to heat alone, the differences between

gutta-percha and gold are differences of degree, and I think this is a natural supposition to which an experimenter would arrive; but there are various other differences between gutta-percha and gold which do not exist between gutta-percha and vulcanite, and these other differences are such that I think a person who had never before seen the two would naturally suppose that gutta-percha and gold were different substances, without taking the trouble to test them by heat.

X Q. 36. Suppose the two plates to be subjected to the action of hot tea, such as is made upon the tea-tables in common use, do you think that after the result had been observed, any one, either an expert, or otherwise, would infer that the two articles were substantially the same manufacture?

592 A. However hot tea may be when it is made, it is not customary for people to take it in their mouths until it has sufficiently cooled down so as not to scald; and I greatly doubt whether tea in that condition, when taken into the mouth of a person who had a dental plate of gutta-percha, or its compounds with earthy matter, would notice any softening of the plate. I am of this opinion because I have had in my own mouth tooth-fillings of gutta-percha, and of Hill's stopping, which I was informed consisted mainly of gutta-percha and the oxide of zinc, and I never noticed that these became softened by the tea which I took into my mouth. It is probable that if the person who had the two plates should subject them to the action of boiling hot tea in a vessel, he would presume that the two had been manufactured in some different way, or were composed of different materials.

X Q. 37. Does not pure gutta-percha soften in water whose temperature is very much less than that of hot tea as it is usually taken into the mouth?

A. I do not know whether it does or does not. In the little working that I have done with gutta-percha, I have invariably subjected it to a higher temperature than that mentioned, and pure gutta-percha is an article which I never saw, except in so small a quantity that I did not attempt to make such an experiment upon it.

X Q. 38. Suppose it is true that gutta-percha is softened at a temperature so low that it can be moulded into the mouth without inconvenience, using the mouth itself for the purpose of giving it shape, is not that temperature lower than the temperature of hot tea, as you usually see it upon the table?

A. As it is generally made as hot as boiling water can make it, when it is first put upon the table, I have no doubt that the temperature assumed in the first part of the question would be lower than the temperature of such hot tea.

X Q. 39. Is not the temperature of 110° Fahrenheit much lower than the temperature at which hot liquids are habitually taken into the mouth?

A. I do not know, because I never tested the temperature at which I took liquids into my mouth by means of a thermometer; but I should think from some other circumstances that a temperature of 110° Fahrenheit is hotter than that of warm liquids which I put into my own mouth, unless by accident.

X Q. 40. Did you mean to tell the court in your direct examination that in your opinion the dental plates made of gutta-percha as de-
593 scribed in the publications you have referred to were substantially the same manufacture as the vulcanite dental plates described in the patent of Cummings?

A. The term manufacture, as used in the present question, appears to

me to be broad enough in its scope to include not only the properties or qualities of the article for the purposes of a dental plate, but also the composition of matter of which it is made. Now I have not meant to tell the court in my direct examination that the composition of matter of which a vulcanite dental plate is formed is the same manufacture as gutta-percha; vulcanite being, in my opinion, a peculiar composition of matter, which makes it a different manufacture from gutta-percha in its unvulcanized state; but I have meant to tell the court in substance that a dental plate of gutta-percha, such as I have referred to, is substantially the same in its mechanical structure with a vulcanite dental plate.

X Q. 38. I have not asked whether vulcanite by itself was the same as gutta-percha by itself. The question I wish answered is this: Is the vulcanite dental plate as described in Cummings's patent, considered as a unit or a new manufacture, substantially the same thing, in your opinion, as the gutta-percha plate described by Edward Truman, Exhibit No. 12?

A. In order to answer the question, I must assume, either that the composition vulcanite, was not invented by Cummings, or that he invented that composition. Assuming that Cummings invented the composition now known as vulcanite at the date that he made his dental plate, I should say that the dental plate which he produced is substantially a new manufacture as compared with what is described in Truman's patent.

Assuming that Cummings did not invent the composition of matter known as vulcanite, there is another fact to be considered, and I have not had the requisite experience, either in the use of dental plates or in observation of such use in the mouths of patients, to enable me to determine with certainty the fact required. I will, however, state the two views.

In the first place, I may say, that inasmuch as the mechanical structure of one of the two kinds of dental plates described in Exhibit 12 (that without the gilding) is substantially the same as the mechanical structure of the vulcanite dental plate of Cummings, he did not produce a new manufacture by changing their mechanical structure of the dental plate when he substituted vulcanite for gutta-percha. The only question then that remains is, whether the substitution of the
594 one known material, vulcanite, in a dental plate, in place of another known material, gutta-percha, introduced into the manufacture of dental plates a property which was different in kind from those before known in such plates, and was valuable for such plates. If the change of material had this effect, it would impart to the dental plates a useful property they did not before possess, and that would, in my opinion, make the dental plate having such new property a new manufacture; but if the substitution of the one material for the other did not impart to the dental plates a useful property for such articles, which they did not before possess, then I think the substitution did not make the vulcanite dental plate of Cummings a different manufacture from the gutta-percha dental plate described in Exhibit No. 12.

X Q. 39. In Exhibit 42 Mr. Truman makes this statement in respect to his dental plate: "I construct a gold wire frame in such a manner as to support the different artificial teeth firmly in their places, and likewise give strength to those parts where the gutta-percha is necessarily thin, as behind the front teeth in the lower jaw; this frame I firmly solder together, rendering it alone as strong as the complete structures on the old plan; but I construct it in such a manner that

in the finished teeth it is imbedded in the centre of the gutta percha, and no part of it allowed to touch either the gums or remaining teeth, its only object being to give firmness and strength and to attach the teeth. I then proceed to mould gutta-percha around this frame on the plaster model in such a manner as to produce the shape required for replacing all the deficient structures of the mouth, placing the mineral teeth already prepared on the pins fixed for their reception, and moulding the gutta-percha around them so as to replace the sockets and gum originally existing around the natural teeth."

Is it your opinion that the mechanical structure of such a plate as that is the same, or substantially the same, as the mechanical structure of the vulcanite dental plate in which the strength of the plate is supplied by the vulcanite, and each tooth is fastened to the vulcanite base, and not to a frame of metal for supporting it?

A. Assuming that the mechanical structure of the vulcanite dental plate is restricted to one in which the teeth are connected with each other only through the intervention of the material which forms the foundation (that comes in contact with the jaws of the patient) and the portions that surround and imbed the teeth in their fastenings,
595 and in which the connection of the teeth with each other by metal fastenings wholly inclosed in that material is excluded, then I should say that the mechanical structure of such a plate as is described by Truman is substantially different from that of the said assumed vulcanite plate.

X Q. 40. Is not the mechanical structure of the vulcanite dental plate on file in the Patent Office as the model of Cummings's invention substantially a different one from that described in Truman's patent and publication?

A. If it be assumed that the said vulcanite dental plate on file is a representative of the only mechanical structure of vulcanite dental plate, then I should say that that particular plate, so far as the mechanical structure of its tooth fastenings is concerned, is a substantially different mechanical structure from that described by Truman; but I think I ought to add, in order that my answer shall not be misunderstood, that I don't understand that the precise mechanical structure in all respects which exists in the said model is the only one which is comprehended or included in the description of vulcanite dental plates given in the Cummings reissue No. 1904.

X Q. 41. Is the mechanical construction of the vulcanite dental plate shown in the drawing of the Cummings patent substantially the same as the mechanical construction of the dental plate described by Truman as already quoted? Confine your answer to the question, without assuming anything but what the drawing shows, and without dragging into it any interpretation of a patent.

A. The two dental plates referred to in the question are substantially the same as respects mechanical structure in the respect that they both have teeth arranged in the same manner; that both have metal fastenings of some kind for securing the teeth in the material of the plate; that in both the material of the foundation which comes in contact with the jaw of the patient and the portions which surround and imbed the lower ends of the teeth in their fastenings are of one material, in one piece, and that the fastenings of the teeth in each case are imbedded in the material of the plate, so that such fastenings cannot come in contact with any parts of the user. The two plates differ substantially as respects the peculiar kind of the fastenings for the teeth; the kind of fastenings represented in said drawing being pins which do not connect

the teeth with each other, while the kind of fastenings described by Truman connect the teeth with each other, as well as fasten the teeth to the material of the plate. If, therefore, the mechanical struct-
596 ure of the vulcanite dental plate shown in the drawings is to be considered to include and be restricted to every minute particular of its structure, and to exclude every modification thereof, then I should say that it was not substantially the same as the mechanical construction of the dental plate described by Truman, as quoted.

X Q. 42. In the Truman plate, does not its strength depend upon a metal structure to which the teeth are attached, and which is complete before the gutta-percha is covered over it to protect the mouth from contact with it, and is it not described to be "alone as strong as the complete structures on the old plan?"

A. In the Truman plate, constructed according to the quotation, the strength depends in part upon that of the metal structure, which connects the teeth, but not wholly, as the plate, when completed, must necessarily possess the combined strength of the metal structure and of the gutta-percha, in the centre of which that metal structure is imbedded.

X Q. 43. Does the gutta-percha add any useful strength to a metal foundation, which is already "as strong as the complete structure on the old plan;" and are you willing to say to the court that in your opinion, in such a case, the gutta-percha is a substantial element of the strength of that plate?

A. I have no doubt that any addition to the strength of the plate is valuable, provided that when strength is added, the plate is not injured in some other respect. And I have no hesitation in informing the court that, in my opinion, in the complete plate made upon the Truman plan, the strength of the gutta-percha, in the centre of which the metal structure is imbedded, constitutes a substantial element of the strength of the completed plate, described in the Truman quotation.

X Q. 44. If the gutta-percha coating were removed from the metallic base and taken in the hand, would it not bend under a very light pressure of the finger?

A. I cannot see how the gutta-percha structure could be removed and yet retain the form and connection of its parts, which it must have when forming a part of the Truman plate described in the quotation; but if it could be removed, and its disconnected parts reconnected, and something could be insered in it which, without adding to its strength, would hold it distended, or tend to prevent it from collapsing, I have no doubt it would be found to possess a considerable amount of strength.
597 The relative strength would of course depend upon the thickness of the mass of material, and the description in Truman conveys to my mind the impression that this thickness is considerable, as the frame or metal structure is described as one made of gold wire, which conveys the impression to my mind that the frame is small in bulk as compared with the entire mass of the dental plate when completed.

X Q. 45. Do you suppose he intended to make his structure thicker than the usual plates if he could help it?

A. I suppose he intended to make his structure as thick as was necessary to reproduce the original form of the jaw before absorption of the alveolar process took place; whether that would be as thick or as thin as previous plates, I am not able to state.

X Q. 47. Do you think that he proposes to add to a frame already as strong as complete structures on the old plan, any thickness of gutta-percha for the purpose of getting the strength of the gutta-percha?

A. What I suppose as respects strength from the description is, that he intended, as he says, to make his frame alone as strong as the complete structures on the old plan, so that he did not rely on the gutta-percha in which it was imbedded for strength; but I also suppose that he did not object to any addition of strength which the gutta-percha used imparted to the plate when completed.

X Q. 48. Does not the plate shown in Cummings's drawing and the model both depend exclusively on the strength of the vulcanite? Answer this, if possible, "yes or no," without dragging in Cummings's patent, or giving construction to it.

A. I think that in both the things mentioned in the question, the strength does not depend exclusively upon the strength of the vulcanite, because if it did the pin fastenings for holding the teeth would not do any work, and I think that the strength imparted by them is important for holding the teeth in their positions, although it does not assist the vulcanite in withstanding a strain which tends to break the plate in two between the teeth.

X Q. 49. Does not the base in the Truman description depend substantially upon a metal frame for its strength; and does not the base shown in the Cummings drawings and model depend exclusively upon vulcanite for its strength?

A. I suppose that the term base is to be considered in the question as including all of the plate except the teeth, and the pins
598 which connect with such teeth; and with this view I may state that the base described in the said Truman quotation depends mainly for its strength, to resist breakage between the teeth, upon the wire frame which is described as being "imbedded in the centre of the gutta-percha," whereas the base of the plate shown in the Cummings drawing and model depends exclusively for its strength to resist breakage in the same way upon the vulcanite.

X Q. 50. Are the two in this respect substantially the same mechanical structures?

A. Limiting the comparison strictly to that peculiarity, they are not substantially the same mechanical structures.

X Q. 51. Considering the teeth, does not Truman's method, described in the Exhibit 42, make the teeth to depend directly upon the metallic frame for their support?

A. The system makes the teeth depend directly, but not wholly, on the metallic frame for their support, as the metallic frame itself is supported in its position in the mouth of the user by the gutta-percha, in the centre of which it is imbedded.

X Q. 52. Are the teeth attached to the gutta-percha at all?

A. They are, both indirectly by their fastenings, consisting of the wire frame and its connections with the teeth, and directly by the contact of the teeth, especially the rough parts of them, with the gutta-percha itself.

X Q. 54. Is there any adhesion between the teeth and the gutta-percha?

A. In those places where the surfaces of the teeth are glazed, I think that the adhesion would be very slight; but in those places where the surfaces of the teeth are rough, I think that the adhesion between the two would be considerable.

X Q. 55. Is not the last thing that Truman does after he has built up his plate to remove the teeth, and afterwards replace them on the pins by cement?

A. I find that I have confounded two descriptions of Truman by

confining my understanding of the description to the quotation which was given me, and assuming that it agrees in all respects with the description in the patent, which I testified to in my direct examination, and in which, as I then stated, I understand there is language which, taken in connection with the residue, describes a complete gutta-percha plate, the teeth of which are not removed for the purpose of gilding their sockets. If I take the whole description in Exhibit 42, in
599 reference to Truman, including the portion which was not quoted to me, and which described the gilding of the sockets of the teeth, then the last things Truman does in completing the plate described in Exhibit 42 are the removal of the teeth, the gilding of the whole plate, including the sockets, and the reapplication of the teeth in their sockets.

X Q. 56. In that case, is there any adhesion to the gutta-percha by the teeth?

A. In that case, there is no adhesion of the teeth and gutta-percha to each other after the plate is finished, as the adhesion was destroyed when the teeth were removed, in order that the sockets might be gilded, and is not afterwards restored, as the coated gilding separates the two.

X Q. 57. Is not that just the same in the patent of Truman, Exhibit No. 12?

A. It is substantially the same in the patent, but the patent goes on and makes a further statement, to which I have before alluded.

X Q. 58. Is there any statement in that patent, directly or indirectly, to the effect that the teeth remain in contact with the gutta-percha when the plate is finished? If so, point it out in that patent?

A. There is, as I understand the language, namely, the following words, taken in connection with the description which precedes them: "It is not essential to making artificial teeth and gums according to my invention that the gutta-percha used should be coated with gold. And I would state that, although I prefer to employ gutta-percha alone, I do not confine myself thereto, as coloring or other matter may be used therewith."

X Q. 60. How does he propose to fasten the teeth in that patent, as he describes the operation?

A. He has already stated that he solders pins to receive them in the above-mentioned frame, and he subsequently states how the gutta-percha is to be applied to the frame and teeth. Now, if the gutta-percha plate when thus completed is not to be gilded, there is no necessity of removing the teeth from the pins and sockets, and the teeth are left in their places as they are, secured by the pins and by the gutta-percha which surrounds the lower end of the teeth and forms the socket in which they set, and which, as the patent states, receive them in like manner as they are naturally articulated in the jaw.

X Q. 61. Does not the patent describe the teeth when the plate
600 is ready for gilding to be in such a condition that they can be taken off the pins?

A. The patent does not speak of the condition of the plate, but I think the inference from the language used in the patent in reference to the removal of the teeth for the purpose of gilding, is that the teeth are not so solidly fastened but that they can be removed from their pins and sockets while the gutta-percha is in a warm condition, in which it is when it has been warmed and pressed into the mouth. The language to which I refer being as follows: . . . "I warm the gutta-percha of the artificial teeth constructed as above explained, and place the same into the mouth and press it into position, by which it will become perfectly

adapted to the mouth. I then remove the same from the mouth and take the teeth off the pins, by which the sockets in the gutta-percha will be left empty."

E. S. RENWICK.

Sworn and subscribed before me this 15th day of November, A. D. 1873.

AUBREY H. SMITH,
Examiner.

And now, by consent of counsel, the cross-examination of this witness is adjourned to Friday, November 21st, at the office of Lee & Alvord, No. 20 Nassau street, New York, before John A. Shields, esq., special examiner.

FRIDAY, *November 21st*, 1873.

Present, counsel as before.

Continuation of the cross-examination of E. S. RENWICK.

X Q. 62. The plate being in such condition that the teeth can be removed from the pins after it has been fitted in the mouth, how will those teeth become permanently set for use except by the process of cementing, as you understand the patent?

A. The question, I presume, has reference to the plate which is not gilded, of which I have been speaking previously. This plate, as I understand the Truman patent, is warmed to enable the gutta-percha to take, by pressure, the precise form of the jaw of the patient, and that is the condition of the plate in which the teeth can be removed from their pins and the sockets. Now, if the teeth are not removed,
601 they will remain fixed in their sockets until the gutta-percha cools down, and holds them with whatever force it is capable of exerting. If, however, the teeth should be removed while the gutta-percha is in the warm condition, and the gutta-percha should be permitted to cool before the teeth are reapplied, it would, of course, be necessary to restore the lost adhesion between the gutta-percha and the teeth by the use of cement, which would in such case intervene in a thin film between the surfaces of the lower ends of the teeth and those of the pins and sockets.

X Q. 63. Has the warmth any effect upon the adhesion of the pins and teeth, as you understand the patent?

A. No.

X Q. 64. Will a tooth pressed into gutta-percha, at the temperature at which it can be borne in the mouth, or at any other temperature whatever mentioned in that patent, adhere to the gutta-percha when it has been cooled with sufficient force to sustain the weight of the tooth?

A. There is no specific temperature mentioned in the patent at which the gutta-percha is to be at the time the metal frame is to be inclosed in it and the gutta-percha is to be moulded around the teeth. I think it is to be inferred, however, that inasmuch as the patentee says, in substance, that gutta-percha when heated is "very plastic," and heated instruments may be used, the gutta-percha when moulded around the teeth is sufficiently hot to be in a very plastic condition. If it were in that condition, I have no doubt that its adhesion to the rough or unglazed portions of the teeth would be abundantly sufficient to sustain the weight of the tooth, although, as I have never tried the experiment, I cannot answer the question with positive certainty.

X Q 65. Suppose it would adhere enough to prevent the tooth from dropping out of its own weight, are you of opinion that it would adhere enough to resist the ordinary process of mastication?

A. If the teeth were well seated in the gutta-percha, as they should be, my opinion is that they would resist the ordinary processes of mastication, for a time at least. As I never made the experiment, however, I have no positive knowledge on the subject.

X Q. 66. Do you mean by that that you believe that an artificial tooth bedded into plastic gutta-percha would have such adhesion to the gutta-percha when it was cooled as that it would resist the disturbance of masticating food?

602 A. In making my previous answer I presumed that the question had reference to teeth held, as described in Truman's patent, by means of pins, as well as by the gutta-percha. If there were gutta-percha alone, without pins to give the teeth lateral rigidity, it is very likely that the teeth might become displaced by mastication; but if the teeth have lateral rigidity imparted to them by pins, my opinion is that the teeth, with the gutta percha moulded around their lower ends, would resist for a considerable period the disturbing tendency incident to ordinary mastication; and it is possible, in my opinion, that they would resist that tendency even if the pins were not used, provided the teeth were well seated.

X Q. 67. Do not the pins in that patent depend upon the metallic base for support?

A. They depend mainly upon the metallic frame for their lateral support, but for their vertical support they depend both on the metal frame and on the gutta-percha, in which that frame is inclosed.

X Q. 68. If these pins were detached from the metal frame, would they be of any service?

A. They might or might not, according to circumstances. If, for example, the inner end of the pins, when detached, did not project beyond the inner ends of the teeth, the pins so detached would not be of any practical service; but if the inner ends of the pins projected into the gutta-percha deeper than the inner ends of the teeth, they would be of service in tending to hold the teeth in their lateral positions.

X Q. 69. Do you consider that the manner in which the teeth are attached to the Truman plate when gilding is not used, and in which they are mounted on pins fixed to a metallic frame, and afterwards imbedded in gutta-percha plastered on that frame, is substantially the same mechanical device, or presents the same mechanical structure, as that shown in the drawing or model of the Cummings patent?

A. It may be proper for me to state, in the first place, that I do not understand the Truman patent to describe the gutta-percha to be merely plastered on the frame, but to describe that the metal frame is inclosed in the gutta-percha, and that the gutta-percha is also moulded around the inner ends of the teeth into the proper form to replace all the lost structures. Now, if the structure shown in the drawings and model of the Cummings patent be assumed to be restricted exclusively to the

603 particular form of tooth-fastenings represented and found in said drawing and model, I should say that the Truman ungilded gutta-percha dental plate was not substantially the same mechanical structure as that shown in the said drawing and model; but if this latter structure be not restricted to the precise form of tooth-fastenings so represented and shown, then, in my opinion, the said Truman dental plate presents substantially the same mechanical structure as that shown in the said drawing and model of the Cummings patent.

X Q. 70. Without attempting to qualify by some supposed restrictions a model shown you, I wish an answer to this question, based upon the thing itself; and I now ask, does not the model show teeth fastened to the base simply by pins connecting each tooth separately to that portion of the base adjacent to it, and depending exclusively upon the strength and adhesion of the material of the base for their support?

A. The model does show teeth fastened to the base both by pins and by whatever adhesion exists between the surfaces of the teeth and the material of the base. In said model, also, the ultimate dependence for the support of the teeth is the material of the base, unless the plate is in the mouth; but inasmuch as some of the teeth bear laterally against each other, these teeth must derive support immediately from their neighbors as well as directly from the portions of the material of the base with which the teeth are in contact, and with which they are connected by the pins.

X Q. 71. In such a manufacture as that, is it necessary or desirable to have a metallic framework to which the pins are attached and upon which the teeth mainly depend for their support?

A. If the user does not care about the teeth becoming loose, it would not be necessary to have a metallic frame imbedded in the material of the plate, but, in my opinion, such a frame would be desirable and would greatly lessen, if not prevent, the teeth from becoming loosened by use.

X Q. 72. Do you mean by this to say that the teeth in the dental vulcanite plate, as commonly made and used, become loose? If so, state the instance within your knowledge in which one ever became loose, and who owned the plate, and under what circumstances the tooth became loose.

A. I meant to express in my preceding answer an opinion as to
604 the matters inquired of. As respects the loosening of teeth by actual use, I may say that inasmuch as I never wore a plate myself, am not a dentist, and have never made inquiries as to whether my acquaintances wore dental plates or not, I have no knowledge as to instances in which teeth have become loose by use. The opinion which I expressed was based partly upon my knowledge of the character of vulcanite and partly upon the examination of the Cummings Patent Office model, in which I noticed that one of the teeth had become loose, and that the surface of the vulcanite indicated that there had not been a very strong adhesion between the surfaces of the teeth and the vulcanite.

X Q. 73. Did you not intend in your 71st answer to convey the impression that in point of fact dental vulcanite plates needed some further protection against loose teeth than what is shown in the model and drawing of the patent?

A. I intended to convey the impression that in my opinion a vulcanite dental plate would be a better article and more desirable if it had some further protection against the loosening of the teeth than what is shown in the model and drawing of the patent; and that in my opinion the teeth would in such event be less liable to become loose.

X Q. 74. If it be true in practice that the teeth of a vulcanite plate do not become loose, having no frame inside of the vulcanite; and if it be true that the teeth be as permanent and firm as when made on gold plate, would you still be of opinion that it would be better to construct a metallic plate first with pins on it and then cover it with vulcanite?

A. The first assumption in the question, as I understand it, is vague enough to include the case in which some other instrument than a frame is employed to prevent the pins from pulling out, but if the second assumption in the question be correct I should consider it useless to use a

frame for the purpose of holding the teeth inward in their places, although I think it would still be better to use a frame for the purpose of increasing the strength of the vulcanite plate.

X Q. 75. Isn't the vulcanite plate strong enough for all practical purposes, without having a metallic frame bedded in it, so far as you know or have been informed? And on this subject I give you leave to state any hearsay information you may have, giving the name of your informer.

(Objected to as incompetent.)

605 A. So far as my own knowledge extends I do not know, either by actual use myself or by observations of use by others, whether the vulcanite plate is or is not strong enough for all practical purposes without having a metallic frame imbedded in it. As respects information derived from others, I do not understand the question as requiring me to state it, but will, of course, do so if asked.

X Q. 76. As an expert undertaking to inform the court in regard to this manufacture, have you not informed yourself on the question whether or not the vulcanite plate, such as described in the patent, and having no metallic frame to increase its strength, is strong enough for all the purposes for which it is intended practically?

A. The only modes in which I could inform myself positively on the subject inquired of would be by actual use or by observations of the use of vulcanite plates by others, and I have had neither opportunity. I have had information on the subject from others as to the actual working of vulcanite dental plates, but I have not made any special inquiries for informing myself on the subject of the actual strength of vulcanite dental plates in use, as I knew they must have possessed some strength or else they would not have been used, and as the matter of strength as compared with dental plates of other materials is only a question of degree.

X Q. 77. Have you or not an opinion on the question whether a vulcanite dental plate, without a metallic frame inside, is strong enough for all practical purposes for which it is used?

A. I have an opinion on the subject.

X Q. 78. What is it?

A. My opinion is, that if a dental vulcanite plate precisely fits the jaw, it is in all probability strong enough for ordinary use, without having a metal frame imbedded in it, although I have frequently seen persons use their teeth for purposes which I have no doubt would cause the fracture of such a vulcanite plate. My opinion also is, that if the vulcanite plate, without having a frame in it, does not when first made truly fit the jaw of the wearer, or if, after having been so fitted, the form of the jaw becomes changed by natural causes, that such a vulcanite plate is not then strong enough for all practical purposes for which it is used.

X Q. 79. State your experience upon which you found your opinion that a vulcanite plate not perfectly fitted is too weak for practical use.

606 A. My opinion, as expressed in the last preceding answer, is based partly on what I know of the nature of vulcanite and partly upon what I know of the strength of the human jaw, as I have, among other things, had the unpleasant experience of breaking some of my natural teeth in ordinary use by accidentally biting upon a hard material.

X Q. 80. Assuming then, if that pleases you better, that the vulcanite dental plate is not practically strong enough for use without a metallic frame inside of it, are you then of opinion that a dental plate which has

a metallic frame inside of it and gutta-percha outside presents substantially the mechanical structure as the vulcanite plate.

A. In the first place, I have not assumed that a vulcanite dental plate is not probably strong enough for ordinary use, when it fits the jaw; but assuming precisely what is stated in the question, I should say that a dental plate which has a metallic frame in it imbedded in gutta-percha, which is moulded around the frame and the lower ends of the teeth, presents substantially the same mechanical structure as the vulcanite plate in the following essential particular, viz, that it has teeth and teeth fastenings, and that the foundation which rests upon the jaw of the patient and the portions which surround and imbed the inner ends of the teeth and their fastenings are of the same material in one piece. I am further of opinion, that so far as the strength of the structure was concerned, the dental plate of gutta-percha with the frame inside would, under the assumption in question, be a stronger plate than the vulcanite plate, and would contain an improved mechanical construction, embodying not only the mechanical structure of the vulcanite plate, but also the additional feature of the frame; and that if the construction of the vulcanite plate were assumed to be restricted to one in which anything in the nature of a frame or performing any of the offices of a frame is excluded, then the gutta-percha dental plate would contain a supplementary mechanical structure substantially different from that which the vulcanite dental plate is assumed to be restricted to.

X Q. 81. Has the dental vulcanite plate of the drawing and model any metallic frame imbedded in it or the equivalent thereof, as you understand?

A. I understand that it has not as represented, but as the dental vulcanite plate of the drawing is the dental vulcanite plate of the patent,
607 I have never understood that the vulcanite plate of the drawing is to be restricted to one which has no frame or anything which performs any the purposes of a frame.

X Q. 82. If you take the frame out of the Truman plate, have you a practical dental plate remaining?

A. If you could take out the frame, leaving a cavity in the plate, and substituting nothing which performed any of the offices of that frame, my opinion is that you would not have a practical dental plate remaining.

X Q. 83. If the cavity were supplied with gutta-percha so that the entire base would be of that material, would that make practically a dental plate fit for use, as you understand it?

A. It would or would not, in my opinion, according to circumstances. If, for example, the frame was removed in such manner as to leave no portions of the pins extending beyond the teeth, I doubt if the plate so changed would be generally useful, although it would be of some service, unless in making the plate the teeth were very deeply imbedded in the gutta-percha. If, on the other hand, the pins after the frame was removed were firmly imbedded in the gutta-percha, or if the pins in addition were constructed so as to be retained firmly in the gutta-percha, I believe that the gutta-percha plate would be a practically useful dental plate, although not as strong as one in which the pins were secured to a frame.

X Q. 84. Haven't you been informed by your employers in this case that gutta-percha cannot be used practically for the construction of dental plates, and that many attempts have been made, but without success, to use it?

A. The only person who employed me in this case was Mr. Baldwin, the counsel for the defendant, whom I have never seen; and I have

never had from Mr. Baldwin any information which was identically or substantially that stated in the question.

X Q, 85. Haven't you had that information substantially from Mr. S. S. White, now present?

A. I have not.

X Q. 86. Haven't you had that information from some person connected with this defense, or consulting with you about it?

(Objected to as not a legitimate or professional inquiry, unless based upon some evidence or matter of proof which has been submitted to the witness in his examination.)

A. I have not.

608 X Q. 87. Have you made any investigation or inquiry whatever to ascertain whether a practically useful dental plate can be made of gutta-percha, such as described in the Truman patent?

A. I have never made a positive test of the matter myself, or made an inquiry as to the exact point inquired of; but I have discussed the matter and made inquiries after I had formed my own opinion on the subject, for the purpose of getting all the information I could on the subject of gutta-percha in addition to that I possessed before I was called upon to act as expert in this case.

X Q. 88. Have you seen specimens of gutta-percha fit for dental use since you have been employed in this case?

A. I have seen specimens which I regarded as fit for the purpose.

X Q. 89. Look at the specimen now shown you, marked Compl't's Ex. "S. S. White," and say whether that is not a sheet of gutta-percha for dental use.

A. I have examined the specimen and believe that it is a compound of gutta-percha, and also that it would be suitable for various dental purposes.

X Q. 90. Is that fit material for constructing a gutta-percha plate of the kind which you say will be practically useful when done?

A. If this material is not compounded with some substance which renders it fusible at too low a temperature, which is a fact I could not ascertain without trial or information, and if it does not contain matter which is deleterious, I think it might be used for making a dental plate, although it does not appear as rigid as the portions of a gutta-percha plate which I have seen; perhaps it may be because it is thinner.

X Q. 91. Look at the piece marked Compl't's Ex. "Gutta-percha," and say whether that is not a piece of natural gutta-percha.

A. The piece referred to in the question appears to be a piece of natural gutta-percha.

X Q. 92. Would it not be very easy to construct a dental plate of either of these materials, and ascertain whether the teeth could be held in it under conditions similar to those of mastication?

A. It would be easy to construct a dental plate of either of the materials if the constructor had the appliances for the purpose and the time to do it in. As regards the holding of the teeth, the best test would be the actual use of the plate.

609 X Q. 93. Did you mean to say in your direct examination that Delabarre (Def't's Ex. 52) described how a dental plate of gutta-percha could be practically made? and, if so, state just how he instructs any one to do it.

A. I intended to state in my direct examination that the exhibit referred to described a gutta-percha dental plate of a certain mechanical construction. I do not recollect as to having said anything as to Delabarre's mode of making that plate.

X Q. 94. After the base of gutta-percha has been moulded according to Delabarre's description, how does he propose to fix teeth into it? Describe the process so that it can be carried out according to Delabarre's method.

A. I understand the description to amount in substance to this, that after the alveolar arch of gutta-percha has been moulded into shape the teeth are inserted into it and secured by means of cramps applied while hot. As a matter of course the insertion of the teeth and the hot cramps would distort the gutta-percha arch, and any ordinary mechanical dentist would naturally restore the form of the arch and press the gutta percha into close contact with the teeth while it was in the plastic state and before it cooled down.

Adjourned to 22d inst. at 11 a. m.

X Q. 95. Describe the instrument called "crampons métalliques" in the description of Delabarre, and state just how they are used to produce the effect intended.

A. The term "crampons métalliques" indicates to me metallic fastenings, resembling in kind the metal cramps which are used for holding stones together in masonry; and they would consist in this case of small pieces of metal, such as wire, having their ends bent, secured by one end in the tooth, and having the other bent end imbedded in the gutta-percha. The description does not state the directions in which they are to extend into the gutta-percha from the teeth, the person who reads the description being left to his own judgment to extend them as he may deem best adapted to attain the object in view, which is to secure the teeth.

X Q. 96. Supposing the front tooth is to be set up on a base of gutta-percha already prepared. State just how it should be done according to Delabarre's description, in order that the experiment may be tried in the most correct way. Describe particularly the cramps, their
610 shape, and how they are to be attached to the gutta-percha in order to make a practically secured tooth. I wish these instructions so specific that a workman may follow them and produce the result.

A. As I have already stated in substance, the description of Delabarre does not contain specific directions as to minute detail; and, therefore, using the language of the question, does not state just how a particular tooth should be cramped in and fast to the gutta-percha.

X Q. 97. Does it state the mode of manufacture with sufficient distinctness to enable an expert like yourself to set up a tooth in a gutta-percha base so that it would be sufficiently firmly secured to be fit for use in a dental plate?

A. I do not pretend to be an expert mechanical dentist, and have had no experience whatever in the fitting of teeth into dental plates of any description. I therefore gravely doubt whether I should be able to produce an article that was valuable or was a fair representation of what would be produced from Delabarre's description by a skilled mechanical dentist who was accustomed to the manufacture of dental plates.

X Q. 98. Does the description show you how a skilled operator should proceed in order to produce a practical dental plate? If so, state the steps he should take in order that they may be followed by a skilled operative for the purpose of producing the dental plate which Delabarre describes for the information of the court.

A. The description shows in general terms how a skilled operative should proceed, but leaves the details to his judgment. The steps that are mentioned are the formation of the matrix, the moulding of the

gutta-percha, and the securing of the teeth in it after it is moulded. All the details of these operations, including the form and direction of the cramps mentioned, as I have before stated in substance, are left to the skill and judgment of the operator.

X Q. 99. Are you not sufficiently instructed by Delabarre's description to enable you to give directions which a skilled operator may follow, and by which a tooth can be fastened to a gutta-percha base so as to have the strength necessary for a dental plate? I do not ask for any other quality than that, and all I desire is to be instructed how a single tooth can be made to adhere to a gutta-percha base by means of a cramp in such a manner that it possibly could be used as a dental plate.

611 A. I presume I could give instructions, but whether they would or would not be such as respects details as were customary in the manufacture of dental plates at the date of this description, I am unable to say.

X Q. 100. Give those instructions, and use any details which Delabarre's description justifies, whether known then or since.

A. Assuming that I wished to have made a dental plate to suit the lower jaw of a patient, I should direct the operator to look about in the market for such teeth as would be suitable for the purpose, taking care that they were of the right size, and that they had wires in them sufficiently long to extend deeply into the gutta-percha, and be bent into cramps; or, if such could not be obtained, to order such teeth to be made. I should also direct him to obtain in the market some of the best gutta-percha that could be got.

I should direct him to produce a mould of the jaw of a patient, and to make by it a fac simile of the jaw, such as I have known to be done in the manufacture of metal dental plates. I should also direct him to make a matrix or hollow mould, corresponding generally with the external form of the gutta-percha plate to be produced, and that in doing this he should take care to make the cavity in the mould large enough to make the gutta-percha thick enough for the purpose required; and if he asked me the thickness, I should say that when the work is done he ought to have at least one-eighth of an inch of gutta-percha both inside and outside of the roots of the teeth in order to afford material enough for permitting the finishing up of the plate after the teeth were set in it. Having got the materials ready, and the teeth with the cramps in them, which, if I was having the job done myself, would be four for each tooth, so arranged as to extend obliquely in different directions into the gutta-percha, I should direct him to procure some boiling water, for, as this description is in a French publication, and the standard thermometer in France is that of centigrade, the temperature of one hundred degrees mentioned corresponds with the temperature of boiling water. I should direct him to soften the gutta percha and work it into shape, taking care that he did not get any water between layers of the gutta-percha, as such water would prevent it from being solid. After he had taken about as much gutta-percha as he thought was necessary to make the plate, I would tell him to mould it into shape between the fac simile of the jaw and the hollow mould I have mentioned, and I would

612 probably tell him that this mode of shaping was to be done like that employed in shaping a metal dental plate in a similar mould. After the gutta-percha had become cold, and he had removed it from the mould, I should tell him to set it up on the fac simile of the jaw and to proceed to insert the teeth with their cramps; and as the directions in Delabarre's description are that the application of these is to be done

while they are hot, I should direct him to heat the cramps and teeth together hot enough to enable them to melt their way into the gutta-percha when they were applied to it. I should also tell him to take care that the cramps extended as far as possible into the gutta-percha consistently with the form which the plate was to have when finished. After he had applied each tooth in its place, I should direct him to go to work to restore the form of the plate, and to use such tools for that purpose as he might deem best, taking care, as is done with metal dental plates, to bring the material of the plate into close contact with the tooth, and I should tell him that if the material was not hot enough to work freely for this purpose he should heat it. After all the teeth were inserted and the material had been pressed into intimate contact with them, I should direct him to let the plate grow hard by cooling. After it was cold I should tell him to go to work and finish up the plate by reducing and smoothing it until he got it to the external form which I should judge to be suitable, and of the desired smoothness, leaving the form of the under side untouched, unless there was some roughness to be removed, so that it might fit the lower jaw of the patient substantially as it fitted the fac simile of that jaw first obtained.

X Q. 101. Are the same instructions applicable to a plate for the upper jaw? If not, give the variations which are to be followed for that purpose.

A. I presume that the same instructions generally would be applicable. The length of the cramps would, of course, have to be varied to suit the particular circumstances of each jaw and of each tooth of the set.

X Q. 102. When I give these instructions to a workman, suppose he says to me that the four pins projecting in different directions from each tooth cannot be diven into the gutta-percha endwise, and that each one will therefore open a slot in the soft material considerably wider than the diameter of the pin, would he state the consequence truly?

A. I should doubt if he would, for the reason that if a piece of
613 hot wire sufficiently hot to melt other gums than gutta-percha is pressed into them, the general rule is that the melted gum closes over the wire as it is pressed downwards; but if I found by examining his work that he stated a fact, I should tell him that he must close up the slots by heating the gutta-percha and pressing it so as to reunite the parts.

X Q. 103. If my workman then asks me what is the object of heating the wires when the gutta-percha has to be softened again in order to imbed to those wires, how shall I explain that to him?

A. In the first place, the gutta-percha would not have to be softened to imbed the wires, except such softening as was done in the immediate vicinity of the wires and teeth by the heat of the wires and teeth. I should, therefore, tell him that the object of heating the wires and teeth was to enable them to melt their way into the gutta-percha so as to permit the teeth and wires to be inserted to the proper depth; and assuming that the slots were formed as has been stated in a previous question, I should tell him that the object of the heating afterwards was to enable the slots to be closed up and the material to be brought in close contact with the surface of the teeth.

X Q. 104. After the melting of the teeth and wires into the gutta-percha and finishing your plate, wouldn't the base have about the consistency of the Exhibit S. S. White?

A. I do not know of what this exhibit is compounded, and whether it may not be compounded with some material such as wax, which would

cause it to melt at a lower temperature than it should do. If, however, the material were thin instead of thick, as it would be in a dental plate at the inner sides of the teeth, I suppose that the consistency, when cold, would be somewhat like that of the exhibit presented to me.

X Q. 105. Is not that exhibit thicker than the ordinary vulcanite plate?

A. I do not know from experience what is the thickness of ordinary vulcanite plates, but taking Def't's Ex. Duplicate Cummings Model, I find that as far as I can ascertain by examination with my hands and eyes, the thickness of the roof portion of that plate inside of the arch is about the same thickness as that of the Exhibit S. S. White, while the thickness in the arched portion is very much greater than that of the Exhibit S. S. White, the thickness of the plate of the said model
614 at the root of the loose molar tooth being over a quarter of an inch, as nearly as I can judge, measured crosswise; and if the thickness be measured in a downward direction at the root of that tooth, and as nearly at right angles with both surfaces as possible, the thickness appears to vary from about one-eighth of an inch upwards to about three-sixteenths of an inch.

X Q. 106. Isn't it very easy to press a tooth-wire, whether it is called "crampon métallique," or otherwise, into pure gutta-percha, such as Exhibit Gutta-percha, without raising its temperature above that of this room for the purpose; and have you not performed that operation now without the least difficulty?

A. I have made the experiment of thrusting a straight wire into a piece of crude gutta-percha. I find that it can be inserted endwise without difficulty, but I find that it cannot be inserted in a direction crosswise of the wire, as the wire bends under the effort, and the difficulty would, in my opinion, be increased if the end of the wire was bent so as to form a crank.

X Q. 107. Would the wire, after being inserted, hold any better if it had been first warmed than it does when inserted cold?

A. I don't know, as I never made a comparative experiment, but I gravely doubt whether the wire could be inserted when the gutta percha was cold, if the wire was first bent into the form of a cramp.

X Q. 108. When the dental plate had been manufactured in the manner you have described, is it your opinion that it would be practically a serviceable dental plate for which dental plates are manufactured?

A. If the quality of gutta-percha were good I believe that the dental plate, when manufactured, would be a practically useful dental plate for service; but of course I don't mean, in making this statement, that it would be as good a dental plate as metallic dental plates, or as vulcanite dental plates, or that it would stand as long in service as such plates, although I think it is probable that a gutta-percha plate for the lower jaw, which admits of a plate of a greater thickness of material than the upper, so far as my observation of dental plates informs me, would probably stand service for a long period.

X Q. 109. Is it your opinion that good natural gutta-percha is rigid enough in the mouth to serve practically the purposes of a dental plate?

615 A. When I had occasion, a number of years ago, to make some experiments with gutta-percha, I noticed that there was considerable difference in its quality, some of it appearing to be much stiffer than other qualities of it, and, in my opinion, the good qualities of it would serve practically the purposes of a dental plate for complete plates. I think it is likely that there are some partial plates which are

required in dentistry for which gutta-percha would not be stiff enough, and in making the above statement I do not mean, of course, to be understood as intending to express the opinion that gutta-percha unvulcanized is, in my opinion, as good a material for the purpose as other materials which are used.

X Q. 110. Are Exhibits "S. S. White and Ggutta-percha" the stiff kind or limber kind of gutta-percha; and if they are the limber kind, can you tell us where we can find the stiff kind, and how we shall know it when we see it?

A. I cannot tell whether the two exhibits referred to are the best quality of gutta-percha or not, as it is a number of years since I have made any tests of gutta percha, and I should have to compare different lots and test them by the temperatures at which they became soft in order to determine which was the best suited for the purpose; that which required the highest temperature to soften it being the best for the purpose. I do not know who are the dealers in the article, but presume that several can be found in the city, and the mode of ascertaining the quality best suited for the purpose is that which I have above indicated of ascertaining the temperatures at which different lots of it become soft.

X Q. 111. Has the stiff kind of gutta-percha any designation in the trade, and where did you buy your stiff kind?

A. I know nothing on the subject of the designation in the trade as I never purchased any. The lots on which I experimented were furnished me by the Gutta-Percha Comb Company, a corporation at that time manufacturing in this city. I noticed at the time that there was a considerable difference in the softening points of different lots, and that some lots appeared to be of a greasy character as compared with others.

X Q. 112. At what temperature does stiff gutt-percha soften, and at what temperature does limber gutta-percha soften, in your experience?

A. I never heard of the designation "limber" gutta-percha un-
616 til this examination; as respects the temperatures at which different qualities of gutta-percha soften, I never attempted to ascertain them.

X Q. 113. Did you ever see in your life any unadulterated gutta-percha (by which I mean, unmixed with other material) which would not soften so that it could be worked with the hand like putty at a temperature of 120° F.; if so, where is that sample, and how did you ascertain that fact?

A. I never but once, that I can recollect, saw a piece of practically unadulterated gutta percha, and I never made the attempt to ascertain the precise temperature by thermometer at which it or any other kind or quality of gutta-percha could be worked in the hand, so that I cannot give any information as to the point inquired of.

X Q. 114. How do you know that the temperature of liquids taken into the mouth, such as hot tea and the like, is not sufficient to soften gutta-percha, if you never ascertained the temperature at which it is softened?

(Obj. to as assuming the witness to have stated, when he has not done so, the fact or assumption upon which the question is predicated.)

A. I know, by having had pieces of gutta-percha in my mouth, that such pieces as I have had do not become materially softened by the temperature of the mouth, and I know that in taking hot liquids into the mouth it is done by sips, in which the liquid comes in contact but momentarily with the teeth and with the parts of the mouth, and does not

come in contact, unless purposely, with the gums, except at the inner side of the front teeth; and I should infer from these facts that gutta-percha of good quality, when placed in contact with the jaws, would not be materially softened by the warm liquids which one generally takes into the mouth.

X Q. 115. Did you ever know or hear of a dental plate of unvulcanized gutta-percha being practically used by any human being; if so, who was the person, and from whom did you derive your information?

A. I have no personal knowledge on the subject. If the question is limited to gutta-percha unadulterated in any manner, I never heard of an unadulterated or pure gutta-percha dental plate being used. If the question includes adulterated gutta-percha, I have heard of such
617 plates being used. The person from whom I had the information was Dr. Asa Hill, who was examined as a witness in this case in Philadelphia.

X Q. 116. Have you any other information than that on the subject?

A. If the question is limited to information derived from hearsay, as the previous one, I have not.

X Q. 117. If a gutta-percha plate were made by the process you have described, would it, in your opinion, be substantially the same manufacture as the dental plate manufactured by Cummings, considered either with reference to the process by which it is made, or the thing itself when made?

A. The dental vulcanite plate of Cummings is formed of a material which is a compound of a vulcanizable gum and sulphur changed by heating to a specific temperature; and this material, as a manufacture, is a different material from unvulcanized gutta-percha. The process, also, by which it is manufactured, including vulcanization, is substantially different from that which is employed to manufacture an article which is not vulcanized. The two dental plates mentioned in the question would, when produced, have substantially the same mechanical structure, and would, so far as I know, possess the same properties and qualities in kind, although they would differ in degree, and they would, as dental plates, so far as I know, be substantially the same articles of manufacture. As, however, I am not a dentist, and have had no means of observing the action of dental plates in the mouth, I have no means of knowing whether either of the plates in use possesses a quality or property which differs in kind from those possessed by the other. If I knew that the substitution of the vulcanite for the gutta-percha imparted to the dental plate a quality or property for practical use different in kind from that possessed by the gutta-percha plate, I should say that the latter was not substantially the same article of manufacture as the former; but if for practical use, the qualities or properties are of the same kind, and vary in degree, as might be expected from the nature of the two materials, I should say that the two were still substantially the same articles of manufacture as dental plates.

X Q. 118. Do you know enough about the subject to say whether they are or are not the same manufacture? Can you answer this yes or no?

A. I believe that I know enough about the subject in every respect but one, namely, the one stated in the latter part of my last pre-
618 ceding answer, and that is, the practical action of the plates in the mouth of the users and the properties exhibited by the plates in actual use; on that point I have no practical knowledge, and am not able to express an opinion which I should consider reliable, as the two plates are substantially the same in all other respects than this, as far as I know, with the exception, of course, of the change in material. I

believe that a practical knowledge of the operation of the dental plates in the mouths of the patients is essential to enable a person to express a reliable opinion as to whether or not a new property in kind, for the purposes of a dental plate, is imparted to dental plates by the use of the material known as vulcanite, and therefore I consider that I have not, on the whole, enough knowledge of the subject to say positively that the two plates are or are not the same articles of manufacture as dental plates.

Redirect:

Q. 119. Assuming that the description of the ungilded gutta-percha plate in the Truman patent, Exhibit No. 12, is in substance that the teeth are removed and reapplied with cement around them, does or does not that change substantially the mechanical structure? Give the reasons and considerations upon which the opinion you may express is based.

A. In my opinion it would not change substantially the mechanical structure of the article. I have noticed that one of the teeth of a duplicate Cummings model is loose. Now, suppose a tooth should become loose in a dental vulcanite plate in use, and the user should have it repaired by having cement applied to the tooth and reinserted in the plate, and that these operations should successively have had to be performed upon each tooth of the plate, I believe that the mechanical structure of the plate, when repaired, would be substantially the same as it was before the first repair was made, and I believe the same result would be attained in the matter of the Truman ungilded plate, if the teeth were removed and were reapplied with cement. The removal of the teeth would break the adhesion between them and their sockets, and the thin film of cement would restore this adhesion.

Q. 120. State whether or not, in your opinion, the structure described in the Cummings patent is limited to a pin fastening for each tooth, giving your reasons.

619 (Compl't's counsel objects to the ex'n of the witness upon the construction of the patent, and among other reasons for this objection he assigns his preference for the opinion of the court, which is not employed by either side, and which, therefore, may be expected to pronounce a more impartial legal judgment. He, however, does not wish to disparage the legal capacity of this witness by making this objection.)

A. As I understand the description of the patent, the structure of vulcanite dental plate therein described is not restricted to any particular form of fastening for the teeth. Pins are described, and they are represented in the drawings as applied in two different ways, and I am not able to find any language in the specification which directs or suggests that pin fastenings, applied in different ways from those represented in the drawings of the patent, or other tooth fastenings than those straight pin fastenings, would make the plate a substantially different structure.

E. S. RENWICK.

J. A. S.

Subscribed and sworn to before me this 21st day of November, 1873.

Counsel for complainant notifies counsel for defendant that he will permit the defendant to produce a witness during the time for taking complainant's proofs, if the defendant chooses, which witness may pro-

duce a dental plate made of gutta-percha in the manner described by Mr. Renwick, and may testify as to its practical value and qualities.

Defendant's counsel puts in evidence certified copy of letters patent, granted to John Allen, Dec. 23, 1851, No. 8621, for improvement in setting mineral teeth; and the same is marked Def't's Exhibit No. 63, Nov. 22, '73, J. A. S., Ex'r.

Also cert. copy letters patent, granted to Mahlon Loomis, dated May 2d, 1854, No. 10847, for improvement in plates for artificial teeth, and marked Def't's Ex. No. 64, Nov. 22, 1873, J. A. S., Ex'r.

Also cert. copy letters patent No. 19916, granted to George Diffenbach, dated April 13th, 1858, for improvement in bases for artificial teeth; and same is marked Def't's Ex. No. 65, Nov. 22, 1873, J. A. S.

620 Also cert. copy from the English patent office of the specification of English letters patent No. 1232, dated May 1st, 1859, to Alfred A. Blandy, for an improved mode of moulding and casting the plates or bases of artificial teeth; and the same is marked Def't's Ex. No. 66, Nov. 22d, '73, J. A. S., Ex'r.

Reserving for consideration and action the offer just made upon the record by compl't's counsel, defendant, in other respects, closes.

621 *Def't's Exhibit* 60.—*Aubrey H. Smith, Examiner.*

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed blue book, consisting of printed cover and four printed pages, contains a true copy of the provisional specification and of the specification of the English letters patent to Charles Goodyear, jr., of No. 42 Avenue Gabriel, Champs Elysées, in the city of Paris, for the invention of improvements in the plates of artificial teeth, sealed the 8th May, 1855, and dated the 14th March, 1855, A. D. 1855, No. 577, plates for artificial teeth, as the said specifications are contained in the bound volumes of specifications of English patents, published at the great seal patent office, London, belonging to this office, and remaining in the library thereof.

In testimony whereof, I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this tenth day of November, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-eighth.

[L. S] J. M. THACHER,
Acting Commissioner.

A. D. 1855. No. 577.—Plates for artificial teeth.

Letters patent to Charles Goodyear, jun'r, of No. 42 Avenue Gabriel, Champs Elysées, in the city of Paris, for the invention of "improvements in the plates of artificial teeth." Sealed the 8th May, 1855, and dated the 14th March, 1855.

Provisional specification left by the said Charles Goodyear, jr., at the office of the Commissioners of Patents, with his petition, on the 14th March, 1855.

622 I, Charles Goodyear, jun'r, of No. 42 Avenue Gabriel, Champs

Elysées, in the city of Paris, do hereby declare the nature of the invention for "improvements in the plates of artificial teeth" to be as follows:

This invention consists of constructing the plates of artificial teeth of the hard product obtained by compounding India rubber or gutta percha (with or without other matters) with sulphur, and subjecting the same to a high temperature. For this purpose I take an impression from the mouth of the patient (in the manner usually practiced by dentists) with wax or suitable plastic material, from which impression I take a cast in plaster of Paris. Upon this model I carefully adjust teeth of the form and size required, and in the position which I wish them afterwards to occupy in the mouth of the patient, using wax or other plastic substance to retain them in the proper position. I then spread a thin coat or layer of wax over portions of the model of the form and thickness required, which layer of wax represents a model of the plate of caoutchouc which is afterwards to support the teeth and keep them firm in the mouth. When the crevices or cavities in or between the teeth are filled up with wax and the model of the plate completed, I take a plaster cast from the same, which cast I prefer should be enclosed in an iron rim or box for the purpose of strength. This, when completed, together with the original plaster model (which I also prefer should be in an iron rim), form a mould, which I use in the following manner:

After removing the wax from the cavities and crevices in or between the teeth, I readjust the teeth in their proper positions in the mould. I then fill up the cavities and crevices and other vacant space in the mould with caoutchouc or gutta-percha suitably prepared with sulphur, and after putting the several parts of the mould together and subjecting them to a sufficient degree of pressure, I cause the whole—that is to say, the mould containing the teeth with the caoutchouc or gutta-percha—to be subjected to heat to convert the compound into the hard product. To obtain a suitable colour I mix with the caoutchouc or gutta-percha vermillion, oxides of zinc or iron, or any colouring substance which will stand the necessary degree of heat with the action of the sulphur. The best compound I believe to be one pound of India rubber or gutta-percha, or of the two combined in suitable proportions, with half a pound of sulphur, together with a suitable quantity of colouring matter.

623 I sometimes find it convenient to substitute the material for the masticators or teeth hidden from view, for which purpose the material is well fitted from its extreme hardness and durability. In order that the teeth may be more firmly attached to the plate, I prefer that they should be jagged or rough, or have small cavities in the roots or parts imbedded in the plates.

Specification in pursuance of the conditions of the letters patent filed by the said Charles Goodyear, jr., in the great seal patent office on the 11th September, 1855.

To all to whom these presents shall come, I, Charles Goodyear, jr., of No. 42, Avenue Gabriel, Champs Elysées, in the city of Paris, send greeting:

Whereas Her Most Excellent Majesty Queen Victoria, by her letters patent, bearing date the fourteenth day of March, in the year of our Lord one thousand eight hundred and fifty-five, in the eighteenth year of her reign, did, for herself, her heirs and successors, give and grant

unto me, the said Charles Goodyear, her special licence, that I, the said Charles Goodyear, my executors, administrators, and assigns, or such others as I, the said Charles Goodyear, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an invention for "improvements in the plates of artificial teeth," upon the condition (amongst others) that I, the said Charles Goodyear, by an instrument in writing under my hand and seal, should particularly describe and ascertain the nature of the said invention, and in what manner the same was to be performed, and cause the same to be filed in the great seal patent office within six calendar months next and immediately after the date of the said letters patent:

Now, know ye that I, the said Charles Goodyear, do hereby declare the nature of the said invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof that is to say:

This invention consists of constructing the plates of artificial teeth of the hard product obtained by compounding India rubber or gutta-
624 percha (with or without other matters) with sulphur, and subjecting the same to a high temperature. For this purpose I take an impression from the mouth of the patient (in the manner usually practiced by dentists) with wax or suitable plastic material, from which impression I take a cast in plaster of Paris. Upon this model I carefully adjust teeth of the form and size required and in the position which I wish them afterwards to occupy in the mouth of the patient, using wax or other plastic substance to retain them in the proper position. I then spread a thin coat or layer of wax over portions of the model of the form and thickness required, which layer of wax represents a model of the plate of caoutchouc which is afterwards to support the teeth and keep them firm in the mouth.

When the crevices or cavities in or between the teeth are filled up with the wax, and the model of the plate completed, I take a plaster cast from the same, which cast I prefer should be enclosed in an iron rim or box for the purpose of strength. This, when completed, together with the original plaster model (which I also prefer should be in an iron rim), form a mould, which I use in the following manner:

After removing the wax from the cavities and crevices in or between the teeth, I readjust the teeth in their proper positions in the mould. I then fill up the cavities and crevices and other vacant space in the mould with caoutchouc or gutta percha, suitably prepared with sulphur, and after putting the several parts of the mould together and subjecting them to a sufficient degree of pressure, I cause the whole, that is to say, the mould containing the teeth, with the caoutchouc or gutta-percha, to be subjected to heat, to convert the compound into the hard product.

To obtain suitable colour, I mix with the caoutchouc or gutta-percha vermillion oxides of zinc or iron, or any colouring substance which will stand the necessary degree of heat with the action of the sulphur. The best compound I believe to be one pound of India rubber or gutta-percha, or of the two combined in suitable proportions, with half a pound of sulphur, together with a suitable quantity of colouring matter.

I sometimes find it convenient to substitute the material for the masticators or teeth hidden from view, for which purpose the material is well fitted from its extreme hardness and durability. In order that the teeth may be more firmly attached to the plate, I prefer that they should be

jagged or rough, or have small cavities in the roots or parts imbedded in the plates.

Having thus described the nature of the said invention, I have
625 only further to state that in thus making improvements in artificial plates and teeth of India rubber and gutta-percha compounds, combined with sulphur, that whilst in the moulds I cause the materials and the moulds to be subjected to heat for about six hours, and in doing so I gradually raise the heat up to about 230° of Fahrenheit, say, in about half an hour, and then, unless there be a considerable quantity of foreign matter present, the heat may be raised as quickly as may be to about 295° of Fahrenheit. Otherwise I raise the heat more slowly, and retain the compound at about that temperature for the remainder of the six hours, and then allow the whole to cool down, when the process will be completed. The artificial plates or teeth thus formed will then be ready to be trimmed and fitted.

I claim the above described manufacture of artificial plates and teeth.

In witness whereof I, the said Charles Goodyear, have hereunto set my hand and seal this eighth day of September, in the year of our Lord one thousand eight hundred and fifty-five.

[L. S.] CHAS. GOODYEAR, JR.

Witness:
FANNY GOODYEAR.

We hereby certify the above to be a true copy.

J. S. ESCOTT,
H. A. CHEESWRIGHT,
Clerks in the Patent Office.

Def't's Exhibit 61.—*Aubrey H. Smith, examiner.*

THE G. D. V. CO. ET AL. }
vs }
D. H. SMITH. }

The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy of the specification of the English letters patent No. 13542, to Alfred Vincent
626 Newton, of 66 Chancery Lane, in the county of Middlesex, London, England, for the invention of improvements in the preparation of materials for a composition or compositions applicable to the manufacture of buttons, knife and razor handles, door-knobs, inkstands, and other articles where hardness, strength, and durability are required, enrolled the fourth day of September, 1851, and dated the 4th day of March, 1851, as the said specification is contained in the bound volumes of specifications of English patents, published at the Great Seal patent office, London, belonging to this office and remaining in the library thereof.

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereto affixed this eleventh day of November, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-eighth.

[L. S.] J. M. THACHER,
Acting Commissioner.

A. D. 1851. No. 13542.

Specification of Alfred Vincent Newton. Composition applicable to the manufacture of buttons, knife and razor handles, door-knobs, inkstands, etc. London. Printed by George E. Eyre and William Spottiswoode, printers to the Queen's Most Excellent Majesty. Published at the Great Seal patent office, 25 Southampton Buildings, Holborn, 1856. Price, 4d.

A. D. 1851. No. 13542.

Composition applicable to the manufacture of buttons, knife and razor handles, door-knobs, inkstands, etc.

NEWTON'S SPECIFICATION.

To all to whom these presents shall come, I, Alfred Vincent Newton, of the office for patents, 66 Chancery Lane, in the county of Middlesex, mechanical draughtsman, send greeting:

Whereas her present most Excellent Majesty Queen Victoria, by her royal letters patent, under the great seal of Great Britain, bearing
627 date at Westminster, the fourth day of March, in the fourteenth year of her reign, did, for herself, her heirs and successors, give and grant unto me, the said Alfred Vincent Newton, her especial license, full power, sole privilege, and authority that I, the said Alfred Vincent Newton, my ex'ors, adm'ors, and assigns, and such others as I, the said Alfred Vincent Newton, my ex'ors, adm'ors, or assigns, should at any time agree with, and with no others, from time to time and at all times during the term of years therein mentioned, should and lawfully might make, use, exercise, and vend, within England, Wales, and the town of Berwick-upon Tweed, and in all Her Majesty's colonies and plantations abroad, and in the islands of Guernsey, Jersey, Alderney, Sark, and Man, an invention of "improvements in the preparation of materials for the production of a composition or compositions applicable to the manufacture of buttons, knife and razor handles, inkstands, door knobs, and other articles where hardness, strength, and durability are required," being a communication from a foreigner residing abroad, in which said letters patent is contained a proviso obliging me, the said Alfred Vincent Newton, by an instrument in writing under my hand and seal, particularly to describe and ascertain the nature of the said invention and in what manner the same is to be performed, and to cause the same to be enrolled in Her Majesty's high court of chancery within six calendar months next and immediately after the date of the said in part recited letters patent, as in and by the same, reference being thereunto had, will more fully and at large appear:

Now know ye, that in compliance with the said proviso, I, the said Alfred Vincent Newton, do hereby declare that the nature of the said invention, and the manner in which the same is to be performed, is particularly described and ascertained in and by the following description thereof, that is to say:

This invention, as communicated to me by my foreign correspondent, relates to the preparation and treatment of caoutchouc and gutta-percha, either alone or in combination, for the purpose of producing a new manufacture or composition applicable to various uses, where hardness, strength, and durability are required. The composition designed to be produced according to the present invention will possess some of the

characteristics of horn, ivory, and jet, and may, according to the color imparted to it, be employed in place thereof; or it may be used as a substitute for costly woods, and be applied to furniture in the form of veneer.

628 Having thus indicated some of the uses of the new manufacture, for the purpose of shewing more distinctly the objects sought to be obtained, I will proceed to describe the manner of carrying out the invention to produce the required result.

In treating caoutchouc for this purpose it is combined with sulphur, the best proportion being about equal parts by weight of each ingredient. By combining sulphur in this proportion with the caoutchouc, and subjecting the compound to the curing operation hereafter to be described, a hard substance will be produced; but a still better result will be obtained by the introduction of magnesia or lime, or of carbonate or sulphate of magnesia, or carbonate or sulphate of lime, or calcined French chalk, or other magnesian earth, into the composition; in which case the following proportions will be found highly advantageous, viz: One pound of caoutchouc, half a pound of sulphur, and half a pound of magnesia or lime or carbonate or sulphate of magnesia, or carbonate or sulphate of lime, or calcined French chalk, or other magnesian earth. The proportions specified in both of these compounds may be considerably varied without materially changing the result; but in no case is it desirable to use a much less quantity of sulphur than four ounces to every pound of caoutchouc. With either of these compounds just described gum lac or gum shellac may be combined to great advantage, say, in the proportion of from four to eight ounces of gum lac to every pound of caoutchouc. Rosin, oxides, or salts of lead or zinc of all colors, and other similar substances, both mineral and vegetable, may be added in small quantities to either of the compounds, for the purposes of imparting a polish or a suitable color thereto, and for making the mixture work more easily, but no precise rule for these additions can be given, nor, indeed, is it necessary, as the taste and judgment of the operator will be his guide in this particular. The compounds produced according to the plans above set forth are next treated in the manner to be presently described; but as this process is equally applicable to the treatment of other compositions included under this invention, I will first explain of what these compositions consist. When using gutta-percha in lieu of india-rubber, the inventor takes certain proportions of gutta-percha, sulphur, magnesia, or lime, or a carbonate or a sulphate of magnesia or lime, or calcined French chalk, or other magnesian earth, and mixes them thoroughly in any convenient manner. The proportions preferred are the following, viz: One pound of gutta-

629 percha, six ounces of sulphur, and from six to eight ounces of either magnesia or lime, or a carbonate or a sulphate of magnesia, or of lime or calcined French chalk, or other magnesian earth. Instead of using the specified proportion of the magnesia or lime, or of the carbonate or sulphate of magnesia or lime, or of calcined French chalk, or other magnesian earth, the same proportion of any two or more of these substances combined may be employed, only taking care that the quantity of this third ingredient in the composition does not vary from the proportion of six or eight ounces. These proportions may, however, be slightly varied without materially changing the result. To the composition above specified a fourth ingredient may be added, viz, gum shellac, by which a still better article will be obtained, the body thus obtained being stronger and more easily worked. The quantity of shellac in such case should be about four ounces to every

pound of gutta-percha. Rosin, oxides, or salts of lead or zinc of all colors, and other like substances, both mineral and vegetable, may be added in small quantities to either of the above compositions, for the purposes before stated with respect to the india-rubber composition.

The compounds or compositions before described, whether of caoutchouc or of gutta-percha, may be mixed by a masticating machine (or by any other means employed in the manufacture of india-rubber compounds), until the several ingredients are thoroughly incorporated. The mineral ingredients mixed with the caoutchouc or gutta-percha should be finely divided, and good results are produced by reducing them before mixture to an impalpable powder. When mixed, the compounds are either rolled into sheets by means of calendering rollers, for the purpose of being used in the manufacture of such articles as the same are applicable to, or formed by moulding or other well-known processes into any desired shape. When thus rolled or moulded, the compounds are then to be "cured." This is effected by exposing the compound to a high degree of artificial heat, using for this purpose either steam, hot water, or hot air. The degree of heat to which the compound is to be exposed, and the duration of its exposure, will depend somewhat upon the size or thickness of the article, but in ordinary cases the heat should be raised to about 260° or 270° Fahrenheit, and the compound exposed to such heat about four hours; as a general rule, however, it may be stated that the heat should range from two hundred and fifty degrees to three hundred degrees Fahrenheit, and the time of exposure from two to six hours. The compounds or compositions, by undergoing this heating or curing operation, will attain a hard and stiff character, in many respects resembling tortoise shells, horn, bone, ivory, and jet.

630

In the compounds described as compositions of caoutchouc considerable proportions of gutta-percha may be substituted for caoutchouc without injury, and in the compounds described as compositions of gutta-percha considerable proportions of caoutchouc may be substituted for gutta-percha without injury.

Under this division of the invention I claim the treating of caoutchouc and of gutta-percha, and of caoutchouc and gutta-percha combined, as above described, for the purpose of producing a composition or compositions applicable to the various uses above set forth.

The second part of the invention refers to certain modes of applying the improved compounds to the production of various articles of manufacture. In many cases the mode of application will be obvious, as the compositions, when hardened, may be worked like wood or bone, but in some instances it is proposed to mould, shape, or otherwise treat the compositions so as to render them better suited to the purpose for which they are intended prior to submitting them to the hardening process. Thus when it is desired to use these new compositions in combination with common flexible vulcanized caoutchouc, as, for instance, in the manufacture of artificial jet bracelets, the parts intended to be hardened may be united to a connecting band or connecting pieces of flexible vulcanized caoutchouc by cementing or pressing together the surfaces required to be joined before the heating or curing process has been effected, by which means during the process of curing the abutting elastic and non-elastic surfaces will become firmly united together. Another plan consists in so treating the compositions while in a plastic state that they will harden into any desired shape. This is effected by the use of sand, pulverized soapstone, or some similar granular matter, to sustain and keep the compounds during the process of heating to the shape into which they were previously moulded. For this purpose the

compounds of caoutchouc or gutta-percha before described are taken in the green or plastic state, and cut or pressed, or otherwise formed into the exact shapes which it is desired they shall retain after vulcanization. The articles thus formed are covered with pulverized soapstone, or other similar non-adhesive powder, placed in a box filled with sand (the finer the sand the better), or pulverized soapstone, or other similar equivalent granular or pulverized matter, so that each article shall be completely surrounded and covered by the sand or pulverized soapstone, and imbedded in the same. When it is desired to give a very smooth surface to the article, it is completely surrounded with a layer of soapstone, even though sand may be employed; about the layer of soapstone sometimes moist sand or pulverized soapstone is used. The articles being thus properly placed in the box, the sand or other material is subjected to pressure, and then by means of a cover, or sometimes by pressure, the consolidated sand or other material is retained in close contact with the articles, so long as the process of heating continues. The articles thus packed are placed in an oven or heater, and subjected to the heating process before described, and upon removing the articles from the sand or other material, they will be found to have attained the requisite hardness, without losing the form which they received before being put into the sand. By this means, with a considerable economy of labor, a great variety of objects may be produced, among which may be enumerated embossed or indented or plain sheets or plates or masses of regular or irregular forms, convex or concave, such as pieces of furniture, book covers, buttons, toys of various kinds, door knobs, and knife-handles.

631

Another mode of applying the compositions consists is uniting them in their plastic or green state with iron or other metals, or rigid substances which will bear a high degree of artificial heat without alteration or damage. For this purpose the article of iron, or other metal or substance which will bear a high degree of artificial heat without alteration or damage, is roughened in such portions of its surface as are intended to be brought into contact with the compound of caoutchouc or gutta-percha, and the compound is then applied to the roughened surface of the article of iron or other substance. When it is desired that the compound of caoutchouc or gutta-percha shall serve as a covering to the iron or other substance, a thin sheet of the compound (sometimes one-thirty-second part of an inch in thickness, or less) is pressed with great care upon the iron or other substance, so as to expel all air from between the adjoining surfaces; and to cause the most perfect union and adhesion, the coated article is bound with strips or ribbons of cloth, or other suitable material, whereby the compound is kept in close contact with the article during the process of hardening. The combined materials thus treated will be found to possess the qualities desired, the iron or other substance giving strength and the compound giving a hard and durable surface. In this way may be produced many articles used in and about harnesses or carriages, such as saddle-trees, buckles, terrets, bits, stirrups, martingale rings, dasher irons, and articles intended to be used as furniture, either whole or in parts, and a great variety of other useful objects. When it is desired to unite these compounds with wood, the wood should be previously prepared by steaming it for several hours, or by other means, so that it shall not be warped or damaged by the high degree of heat to which it will be subjected.

632

Under this head of the invention I claim the completion of the manufacture of the composition or compositions having the qualities above

mentioned, after the application of the same to any one or more of the purposes indicated in the title of the above in part recited letters patent.

In witness whereof I, the said Alfred Vincent Newton, have hereunto set my hand and seal this fourth day of September, in the year of our Lord one thousand eight hundred and fifty-one.

A. V. NEWTON. [L. S.]

And be it remembered that on the fourth day of September, in the year of our Lord 1851, the aforesaid Alfred Vincent Newton came before our said Lady the Queen in her chancery, and acknowledged the specification aforesaid, and all and everything therein contained and specified in form above written. And also the specification aforesaid was stamped according to the tenor of the statute made for that purpose.

Enrolled the fourth day of September, in the year of our Lord one thousand eight hundred and fifty-one.

MOWBRAY.

London. Printed by George Edward Eyre and William Spottiswoode, printers to the Queen's most Excellent Majesty. 1856.

632*a* (diagram) follows.

633 Deft's Exhibit 63.

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the letters patent granted John Allen, dated December 23d, 1851, No. 8621, for "improvement in setting mineral teeth."

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this sixteenth day of October, in the year of our Lord one thousand eight hundred and seventy-two, and of the Independence of the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

No. 8621.

The United States of America to all to whom these letters patent shall come:

Whereas John Allen, of Cincinnati, O., has alleged that he has invented a new and useful improvement in setting mineral teeth, which he states has not been known or used before his application; has made oath that he is a citizen of the United States, that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are, therefore, to grant, according to law, to the said John Allen, his heirs, administrators, or assigns, for the term of fourteen years
634 from the twenty-third day of December, one thousand eight hundred and fifty-one, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Allen in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand at the ci y of Washington this twenty-third day of December, in the year of our Lord one thousand eight hundred and fifty-one, and of the Independence of the United States of America the seventy-sixth.

ALEX'R H. H. STUART,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[L. S.]
THOS. EWBANK,
Commissioner of Patents.

The schedule referred to in these letters patent and making part of the same.

To whom it may concern:

Be it known that I, John Allen, of Cincinnati, in the county of Hamilton, and State of Ohio, have invented a new and useful mode of setting mineral teeth on metallic plates, and I do hereby declare that the following is a full and exact description of the same.

To enable others skilled in the dental art to make and use my discoveries, I will proceed to describe the composition and mode of application.

The cement may be formed of any of the known fluxes combined with silex, wedgewood, and asbestos, intermixed with gold and platinum scraps, which forms a metallic union with the plate upon which the teeth are set. The compound which I prefer is composed of silex, 2 oz.; white or fluid glass, 2 oz.; borax, 1 oz.; wedgewood, 1½ oz.; asbestos, 2 drms.; felspar, 2 drms.; kaolin clay, 1 drm. This compound should be intermixed or underlaid upon the plate with gold and platinum
635 scraps. The gum color consists of felspar, ½ oz.; white glass, 1 oz.; oxyde of gold, 1½ grs. Mix, moisten, and apply with a brush.

APPLICATION.

I construct my plates and arrange the teeth thereon in the usual way. I then apply the cement in a plastic state upon the outside, between and around the base of the teeth, so as to form an artificial gum upon the teeth, and plate. The teeth and gum are then covered with a mixture of asbestos and plaster of Paris, mixed with water and reduced to a plastic state. The teeth being thus covered, the wax is removed from the inside of the teeth, and the cement is applied thereupon, and also upon the plate, so as to fill up all the interstices around the base of the teeth. When the cement and mixture thus applied become thoroughly dry, the work so united is put into a furnace, sufficiently heated to fuse the cement, and immediately after the fusion thereof it is withdrawn from the furnace and cooled slowly.

The plaster mixture is then removed, and a gum color applied. The work is again placed in the furnace, as before, and, when fused, is with-

drawn and cooled, as before, by which means the metallic back plates, solder, and blow-pipe are dispensed with, although back plates may be attached to the teeth if desired. Finally,

What I claim as my invention, and desire to secure by letters patent, is a new mode of setting mineral teeth on metallic plates, by means of a fusible silicious cement, which forms an artificial gum, and which also unites single teeth to each other and to the plates upon which they are set.

I also claim to be the inventor of said cement or compounds, a full and exact description of which is herein given.

I also claim the combination of asbestos with plaster of Paris, for covering the teeth, and plates for the purpose of sustaining them in their proper position while the cement is being fused.

P. S.—In the accompanying drawing, No. 1 represents the metallic plate; No. 2, the gum color, and No. 3, the mineral teeth.

JOHN ALLEN.

Witnesses:
NIRUM ALLEN.
CHAS. D. ALLEN.

Exd.—H. H.

636 *Def't's Exhibit* 64. *November 22d*, 1873.—*J. A. S., Ex.*

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

The United States Patent Office, to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the letters patent granted George Deiffenbach, dated April 13th, 1858, No. 19916, for "improvement in bases for artificial teeth."

In testimony whereof, I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed, this eighteenth day of November, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-eighth.

[L. S.]

J. M. THACHER,
Acting Commissioner.

The United States of America, to all to whom these letters patent shall come:

Whereas, George Deiffenbach, of New York, N. Y., has alleged that he has invented a new and useful improvement in bases for artificial teeth, which, he states, has not been known or used before his application; has made oath that he is a citizen of the United States, that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty dollars, and
637 presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are therefore to grant, according to law, to the said George

Deiffenbach, his heirs, administrators, or assigns, for the term of fourteen years from the thirteenth day of April, one thousand eight hundred and fifty-eight, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said George Deiffenbach in the schedule hereunto annexed and is made part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand at the city of Washington, this thirteenth day of April, in the year of our Lord one thousand eight hundred and fifty-eight, and of the Independence of the United States of America the eighty-second.

JACOB THOMPSON,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[L. S.]
J. HOLT,
Commissioner of Patents.

The schedule referred to in these letters patent, and making part of the same.

Be it known, that I, George Dieffenbach, of the city, county, and State of New York, have invented a new and improved base for artificial teeth; and I do hereby declare that the following is a full, clear, and exact description of my invention and of its application:

The substances at present in use, or the use of which has been attempted for the purpose of forming a base for artificial teeth, are, metals, ivory, hippopotamus, and gutta-percha. My experience in dentistry having shown to me the serious disadvantages consequent upon
638 the use of the said materials for the said purpose, I deem it necessary in the first place to detail these injurious effects, as follows:

1. All metals, being good conductors of heat, cause a disagreeable sensation of chill in the mouth by their rapid absorption of its natural heat.

2. The perpetual contact of every metal with parts of the mouth causes a disagreeable taste, an unnatural excitement of the glands, an increased secretion of the saliva, and with some persons, a weakening of the nervous system.

3. Most of the metals oxidize by the action of the stomach-acid. Platina is an exception to this rule, but its great weight makes its retention in the mouth a matter of great difficulty.

4. The proper shape of a metallic base for artificial teeth not being obtainable by a direct process, is inexact in many cases, and its retention in the mouth, as well as its service in chewing, is thereby rendered extremely difficult.

5. All metals used for this purpose are liable to bend and to lose their original shape by a continued use in the mouth.

6. Ivory, hippopotamus, and gutta percha are injuriously effected by the saliva; they frequently require renewals, and emit, moreover, a disagreeable odor.

These defects have induced me to invent a composition of matter, which may be worn in the mouth without being liable to any of the injurious effects above enumerated. The idea soon suggested itself to me that amber was free from all these defects, but I found it too brittle to be formed in the proper shapes. I have, therefore, endeavored, by

an extended series of observations and experiments, to form a composition of the matter in which amber was to be the principal ingredient, and which could be cast or molded into the various shapes necessary for the base of artificial teeth; and my efforts having become successful, I will here state that the nature of my invention consists in forming a proper base for artificial teeth of a composition of matter containing amber as its most prominent ingredient.

To enable others skilled in the art to make and use my invention, I will proceed to describe its composition and application.

I pulverize amber, and put the same in a crucible (the inside of which ought to be glazed) over a soft-coal fire, the intensity of which is gradually increased until the amber begins to melt, when it is agitated until the whole of the pulverized amber is molten. I then take linseed
639 oil, and pour the same, while in a boiling state, into the molten amber, and agitate the mixture. I then remove it from the fire, but continue to stir it until it becomes cool. In this state the composition, although less brittle than pure amber, does not possess the tenacity requisite for my purpose; I therefore add pulverized sulphur, and mix the whole well together. I then put the same in an iron retort, and apply heat to the same until the whole mass is gradually hardened. I deem it proper to state that I have found steam heat the most advantageous for my purpose, and that bringing the retort in direct contact with the fire somewhat injures the result. And I will further remark that I have varied the proportions of these ingredients, but I have found the following to be sufficiently accurate for my purpose. I take to one pound of amber one-half pound of prepared linseed oil, two ounces of sulphur. I have named linseed oil and sulphur because they are the cheapest substances known to me to effect the desired end. Caoutchouc may be added in small quantities without impairing the result, but I do not claim such addition as any part of my invention. I am also enabled to impart to the above-described composition any color that may be deemed desirable by the admixture of proper pigments during the process of preparation. I use this composition to form the following parts of the mouth, namely, the gum, the alveola (maxilla inferior), the palate (maxilla superior), and the jaw, thus acquiring a complete base for artificial teeth.

I make these articles in the following manner: I take an impression in wax or in plaster of Paris of that part of the mouth which I wish to imitate. I then pour fluid plaster into that impression (with the usual precaution of separating), and leave it therein until dry; thereby I obtain the original mold. I then arrange and fasten the requisite number of artificial teeth on this mold, which is now ready to receive the hot composition, consisting of amber, linseed oil, gutta-percha, and sulphur, as above described. This is now put into the model, and its thickness regulated as desired. I then put the plaster model, with its contents, into the retort above described, leaving it there until fully hardened. When removed, the artificial base is complete in form and in substance. It will be seen that I obtain my ultimate form direct from the original mold (whereas the use of metals requires the original mold to be formed in sand and cast in a metal, which has to be recast in a softer metal, called the female mold, which is separated from the other, and
640 the sheet metal for the base is put between the two molds and hammered or stamped between them).

The great usefulness of this invention for dental purposes, and its superiority over the existing methods of forming a base for artificial teeth, consists in the following points:

1. The amber composition is tasteless; it causes no excitement of the glands; it creates an agreeable feeling in the mouth, and emits no odor.

2. The contact between the amber composition and the mouth is not injurious to health, and acts as preventive against some diseases, such as inflammation of the throat, and so forth.

3. Being a bad conductor of heat, it does not cause sudden feelings of cold in the mouth.

4. It is not liable to oxidation, corrosion, or solution by the action of the stomach-acid or saliva.

5. It is capable of bearing extreme degrees of heat and cold without suffering any injury therefrom.

6. It can be easily cast into any shape suitable to the mouth; it is not liable to bend; it always retains its form; and for these reasons it affords great security for its retention in the mouth and increased facility in chewing.

7. Being enabled to firmly unite the artificial teeth with this composition without the use of any other cement or solder, by uniting them before the composition becomes hardened, I obtain a compact body and avoid pores between the teeth and their base.

8. It is cheaper than most of the metals. What I claim as new, and desire to secure by letters patent, is,

Making the base for artificial teeth of a composition of matter in which amber forms the principal ingredient, in the manner substantially as described.

GEORGE DIEFFENBACH.

Witnesses:
CHS. WEHLE.
JOHN MOODY.

Exd.—J. D.

641 *Def'ts Exhibit* 65.

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

The United States Patent-Office, to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the letters patent granted Mahlon Loomis, dated May 2d, 1854, No. 10847, for "improvement in plates for artificial teeth."

In testimony whereof, I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed, this nineteenth day of November, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-eighth.

[L. S.] J. M. THACHER,
Acting Commissioner.

No. 10847.

The United States of America, to all to whom these letters patent shall come:

Whereas Mahlon Loomis, of Cambridgeport, Mass., has alleged that he has invented a new and useful improvement in plates for artificial

teeth, which he states has not been known or used before his application; has made oath that he is a citizen of the United States; that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in said improvement, and praying that a patent may be granted for that purpose:

642 These are therefore to grant, according to law, to the said Mahlon Loomis, his heirs, administrators, or assigns, for the term of fourteen years from the second day of May, one thousand eight hundred and fifty-four, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used the said improvement, a description whereof is given in the words of the said Loomis in the schedule hereunto annexed, and is made a part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand, at the city of Washington, this second day of May, in the year of our Lord one thousand eight hundred and fifty-four, and of the Independence of the United States of America the seventy-eighth.

[L. S.] ROBERT McCLELLAND,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent-Office.
S. T. SHUGERT,
Act'g Commissioner of Patents.

The schedule referred to in these letters patent, and making part of the same.

To all persons to whom these presents shall come:

Be it known that I, Mahlon Loomis, of Cambridgeport, in the county of Middlesex, State of Massachusetts, have invented a new and useful improvement in the manufacture of artificial teeth, and do hereby declare that the same is fully described in the following specifications and accompanying drawings, letters, figures, and references thereof.

Of the said drawings Figure 1 represents a perspective view of my improved upper jaw half sets of teeth.

Figure 2 is a perspective view of the lower jaw half sets of the kind.

Figures 3 and 4 are longitudinal sections of such half sets.

Figure 5 is a top view of the half mould of the upper jaw, the same exhibiting by the colored portion *a* the amount of enlargement for shrinkage of the porcelain as hereinbefore described.

643 Figure 6 is a similar view of the lower part of the mould for the lower jaw set, and shows the process of enlargement for such purpose, it being effected by sawing the mould longitudinally and transversely into four pieces *b*, *c*, *d*, *e*, and extending them apart, and inserting strips of wood, *f*, *g*, between them.

My invention consists in making whole sets of the upper or lower halves or parts of sets of artificial teeth all of porcelain. A half set consists of but one piece of material, there being no metallic plate as in the usual way, but the same material of which the teeth themselves are made is used instead of a metallic plate.

To make a full set of artificial teeth, thin silver-plated or other proper metallic plates are first to be accurately fitted to the upper and lower

jaws, in order that the exact size and shape of that part of the mouth to be fitted may be definitely known.

These plates are to be made by the ordinary process of gold plates, to which sets of teeth are usually fastened.

Wax is next to be placed upon these plates, in order to determine somewhat the length and position of the teeth to be made. Next, the inside of the plate on that side which is applied to the flesh of the mouth is to be filled and covered over with dentists' plaster (wet to a convenient consistence), and said plate with the plaster is to be placed upon a thin bed of the same plaster, so that the plaster on the plate shall rest on the bed of plaster. To prevent the bed of plaster from spreading, and the better to shape it, it may be confined by means of a strip of sheet iron about an inch in width, bent somewhat in the form of the letter W, and continued straight across so that the ends may touch each other.

When this bed of plaster has become sufficiently hardened, the sheet iron or metallic form last mentioned is to be removed. The metallic plate is next to be taken off from the whole of the plaster. The plaster after this may be neatly trimmed.

When the plaster cast, upon which is to be formed the upper half of the set of teeth, is to be enlarged to counteract in part the effect of the shrinkage of the porcelain material consequent upon baking, such may be effected as follows:

As different mixtures for porcelain differ in the amount they contract by baking, the extent of enlargement—as near as I can estimate this enlargement, I should say that generally speaking it would increase each of the dimensions of the mould one sixteenth of it—must be in proportion to the amount of shrinkage, which may be ascertained by measurement and experiment. This ascertained, the aforesaid plaster cast upon which is to be formed the half set or that portion for the upper jaw may be scooped out sufficiently to allow for shrinkage, and it may be extended back or lengthened the proportional distance from the mark left by the rear edge or limit of the plate, and so as to allow for the longitudinal shrinkage.

644

When the enlargement of the plaster cast has been completed, the wax which was before placed on the metallic plate is to be removed therefrom and placed on the plaster cast, the deficiency at its two extremities being supplied, if necessary, its height and breadth corrected (is requisite) by the addition of other portions of wax. This wax so put on the cast is designed to form a space between the two pieces of plaster which are to compose the matrix for forming the porcelain material of the teeth. After the wax has been thus adjusted it may be oiled, in order that prepared plaster which is next to be poured or placed upon and over both the wax and remaining surface of the plaster cast upon which it is placed may be subsequently the more easily separated from said wax and plaster, which separation is to be effected when this plaster last used has become hard or set. This plaster last put on is for the purpose of forming the other portion of the matrix. Next a sufficient portion of the plaster so removed must be cut away from the whole mass, in order to make, when the two parts of the mould are placed in contact, a space which will admit of the porcelain mixture running back far enough to form that portion of the upper part of the set which is usually made of metallic plate. The space thus made between the masses of plaster constitutes the matrix for forming the upper portions of the set of teeth.

That matrix for forming the lower portion of the set of teeth is to be

made in a similar manner. The enlargement may be done by sawing the mass of plaster apart crosswise, and next glueing the parts firmly together with a piece of wood between them, such piece of wood to correspond in thickness with the amount of shrinkage of the porcelain material in a longitudinal direction.

Next the whole may be again cut apart at right angles with the first separation, and again glued together with a similar strip of wood between the two halves, such strips allowing for the transverse shrinkage.

Now, the inferior or last made half of each of these matrices may be spaced off upon the edge which determines the outer surface of the porcelain material, and so as to determine the width and position of the teeth to be made.

645 First, that for the upper teeth is spaced to suit the occasion. Then to space that for the lower teeth, the flat side of the two may be placed together, and that for the lower teeth spaced by marking between the spaces of that for the upper teeth.

Then, after thinly coating with bayberry tallow that surface of the matrix which is a representation of the part of the mouth to be fitted, it is ready to receive the porcelain material, which may next be carved or shaped as may be necessary.

This being done, the mass of porcelain material may be warmed until it melts the tallow beneath, so as to admit of its being removed from the matrix. While in this condition any desirable shape may be given to its edges of the part so formed in the matrix, by applying, where desired, a thinly-diluted portion of the porcelain mixture by means of a small camel's-hair pencil. Next the cast is to be placed upon the tile for baking it in the usual way, as practiced in manufacturing porcelain. After the two portions have been taken from the furnace the last time, they may be ground on their inside surfaces where they may need it, in order to make them fit accurately a plaster bed or perfect representation of that part of the mouth which it is desired to fit. When the mouth *is* to be fitted with teeth is of such a peculiar shape as to render it a difficult operation to remove the carved work from the matrix which faithfully represents it, as is sometimes the case with the upper jaw, the difficulty may be obviated in the following manner:

After the metallic plate has been accurately fitted to the mouth it may be taken and oiled on its inside surface.

Next, with dentist's plaster moistened to a convenient consistence such portions of the oiled surface of the plate may be covered as shall most seem to interfere with its direct removal from the hardened mass of plaster which is afterward made to fill it.

And it is well to divide into small separate pieces that plaster which is thus first placed in the plate, in order that it may be subsequently more easily removed from the work which is to be shaped and carved upon it.

Next, when these plaster pieces have become hard, their outer surface should be thinly covered with bayberry tallow, or its equivalent.

The remaining portion of the oiled surface of the plate is next filled and covered over with a similar preparation of plaster. When this becomes hard, it is also to be covered with bayberry tallow, or the

646 equivalent, and the tallowed surface placed upon a thin bed of prepared plaster, confined to its place by means of a sheet-iron form as before spoken of.

The plate may next be removed, and the mould enlarged and finished in the same way as the matrix before described.

Some o the advantages of making sets of teeth in my way are quite apparent, for a half set thus all solid and in one piece of material will be in use a cleaner and purer job than those made in the usual way (viz, of gold, metallic plate and teeth fitted thereto), there being no joints around the teeth made after my plan for the accumulation of foreign substances.

They can also be afforded at an incomparably lower price than those as usually made, thus extending the benefits of artificial teeth to hundreds of persons who cannot afford them on gold or platina plates.

In actual practice I find it is much easier to make teeth in this way, my method proving to be a great saving of time and labor. I have fitted several jaws, both upper and lower, with sets of teeth made on my improved plan, which teeth are now in daily use, answering every requirement.

I do not claim the process above set forth. In making sets of artificial teeth, I do not claim the spreading of a gum enamel over one side of a metallic roof plate, upon which the teeth are fastened, nor the extension of the porcelain gum some way and not entirely upon the roof; but

What I claim as my invention, is the improved manufacture of whole or half sets of porcelain or mineral teeth substantially as described.

In testimony whereof I have hereto set my signature this twenty-sixth day of October, A. D. 1853.

MAHLON LOOMIS.

Witnesses:
R. H. EDDY.
F. P. HALE, JR.

Ex'd.—A. R.

647 *Def't's Exhibit No. 66.—November 22d, 1873.—J. A. S., Examiner.*

THE G. D. V. CO. ET AL.
vs.
D. H. SMITH.

A. D. 1857. No. 1232.

Moulding and casting the plate or bases of artificial teeth. Letters patent to Alfred A. Blandy, M. D., D. D. S., of the city and county of Baltimore, and State of Maryland, in the United States of America, for the invention of "An improved mode of moulding and casting the plates or bases of artificial teeth." Sealed the 27th October, 1857, and dated the 1st May, 1857.

Provisional specification left by the said Alfred A. Blandy at the office of the Commissioners of Patents, with his petition, on the 1st May, 1857.

I, Alfred A. Blandy, M. D., D. D. S., of the city and county of Baltimore, and State of Maryland, in the United States of America, do hereby declare the nature of the said invention for "An improved mode of moulding and casting the plates or bases of artificial teeth" to be as follows:

This invention relates, firstly, to a peculiar process of moulding the plate or base of the teeth, by which a correct articulation can be had upon casting.

Secondly, to the use of an alloy suitable, from its chemical and physi

cal properties, to form the plate or base of artificial teeth that will not practically shrink or expand in cooling or solidifying after being cast, whereby an accurate fit of the plate to the gums can be had.

And, thirdly, to the use of a matrix, which, from the nature of its component parts, will not shrink or expand on being heated or cooled.

To illustrate the moulding process, let it be supposed that a
648 case of teeth for the upper jaw is required. An "impression" of the upper jaw is first taken in wax, and recast to form the upper half of the matrix. Upon this cast a thin plate of metallic foil coated with wax is pressed down in a careful manner to represent the plate or base of the teeth, after which a rim of wax of about one-quarter of an inch thick is fitted upon it to represent the teeth; the plate and rim thus prepared are then removed from the model and inserted in the mouth of the patient to obtain the just acclusion or bite, by cutting down or trimming the rim of wax, as circumstances may require.

When properly trimmed, the plate is removed from the mouth, and the teeth requisite to supply the want are then carefully fitted upon the wax rim, after which the redundant wax is removed. The plate and rim thus armed with the teeth are placed upon the model or upper half of the matrix, ready to receive the composition which is to form the lower flask of the matrix. The latter, when solidified and sufficiently hardened, may be removed from the upper flask, carrying with it the plate, the rim of wax, and the teeth which are imbedded in it. The wax and foil may now be carefully removed, and withdrawn from around the teeth and the lower flask. A gate or aperture is then cut in the flask to permit a free influx of the metal to form the plate of the teeth and to allow the air and gas to escape. The two flasks are now brought together and firmly secured by means of wire. The mould thus formed is heated, and the molten metal may be poured into it with perfect safety to the teeth. To prevent the shrinking or expansion of the matrix the following composition is used, viz, equal parts or nearly so of feldspar and plaster of paris, thoroughly incorporated with each other.

The metallic alloy used for forming the plate is composed of bismuth and antimony combined, either singly or together, with tin, cadmium, and silver in suitable proportions.

The expansive properties of the antimony and bismuth on cooling are intended to neutralize the shrinkage on the part of the other metals. They also serve, in conjunction with the silver and cadmium, to give that hardness, strength, and rigidity to the alloy necessary to render it suitable to form the dental plate. The plate, when completed, if desired, may be readily and durably coated with pure gold.

649 Specification in pursuance of the condition of the letters patent filed by the said Alfred A. Blandy in the great seal patent-office on the 29th October, 1857.

To all to whom these presents shall come. I, Alfred A. Blandy, M. D., D. D. S., of the city and county of Baltimore, State of Maryland, in the United States of America, send greeting:

Whereas her most excellent Majesty Queen Victoria, by her letters patent bearing date the first day of May, A. D. 1857, in the twentieth year of her reign, did for herself, her heirs and successors, give and grant unto me, the said Alfred A. Blandy, her special license that I, the said Alfred A. Blandy, my executors, administrators, or assigns, or such others as I, the said Alfred A. Blandy, my executors, administrators, or assigns, should at any time agree with, and no others, from time to time

and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an invention for "an improved mode of moulding and casting the plates or 'bases' of artificial teeth," upon the condition, amongst others, that I, the said Alfred A. Blandy, by an instrument in writing under my hand and seal, should particularly describe and ascertain the nature of the said invention, and in what manner the same was to be performed, and cause the same to be filed in the great seal patent-office within six calendar months next and immediately after the date of the said letters patent:

Now know ye, that I, the said Alfred A. Blandy, do hereby declare the nature of my said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, reference being had to the drawing hereunto annexed, and to the letters and figures marked thereon (that is to say):

My invention consists in four separate and distinct features, all of which are required to form a perfect denture by the process of casting, as contradistinguished from the process of swaging, altho' either of these features may be used separately with a beneficial effect upon the old plans or processes. The first of these consists in a peculiar process, by means of which a correct articulation of the teeth can be had, and an absolute fit of the plate to the mouth obtained. The second consists in so forming the roots, or that part of the tooth intended to be imbedded in the plate, as to adapt it to the process of casting, so that a firm retention of the plate to the tooth is obtained by the simple act of casting the plate. The third consists in the use of a matrix so composed of certain ingredients as that when exposed to the action of heat at a given temperature it will neither shrink nor expand, thus removing the possibility of the plate when cast being either too large or too small. And the fourth consists in casting the plates or "bases" of an alloyed metal, which after being cast will not shrink or expand on solidifying or cooling.

These I will now proceed to describe in detail and in connexion with each, reference being had to the accompanying drawing, in which figures 1 and 2 represent side elevations of a jointed plaster cast, technically termed the "articulator," the front half of which may be taken to represent the upper and lower jaw during my process preparatory to the adjustment of the teeth thereon.

In Figure 1 the wax rim is represented as being too long in front, and in Figure 2 as properly trimmed; Figure 3 represents a vertical longitudinal section of Figure 2; Figure 4 represents a side elevation of the upper half of the "articulator" after the teeth have been adjusted and the wax reduced to the proper shape and thickness preparatory to moulding. Figure 5 represents a vertical longitudinal section (through a central incisor tooth) of the moulding flask, with the teeth and pattern plate enclosed; and Figure 6 a similar view of the same, but showing the pattern plate removed and prepared for pouring the metal intended to form the "base" or plate. Figure 7 represents a view in perspective of a tooth adapted to the process of casting, and Figures 8 and 9 a plan and section of the same respectively. Figure 10 represents a plan of a block of teeth adapted to my process; and Figure 11 a transverse vertical section of the same, taken centrally through it. Figure 12 represents a view in perspective of an upper set of teeth completed out of my improved alloy, and by my peculiar process; and Figure 13 a similar view of the same, but represented as being electro gilded.

An impression of the mouth in wax is first obtained as in other processes, from which a plaster cast is taken, which subsequently forms one-half (A), Figures 5 and 6, of the moulding flask; upon this cast a pattern plate (*a*) (made of rolled wax, and $\frac{1}{30}$ to $\frac{1}{50}$ of an inch thick
651 and lined on the side next the cast with metallic foil $\frac{1}{200}$ to $\frac{1}{300}$ of an inch thick) is carefully pressed and trimmed to the required shape, after which a rim (*b*) of wax of about $\frac{1}{4}$ of an inch wide is placed upon the alveolar ridge of the same. When this is completed, the process is repeated for the lower jaw in cases of entire loss of teeth, in which event both plates with their wax rims are then introduced into the mouth, and the wax trimmed down until the two rims touch at all points, as shown in Figure 2, due attention being had to the correct closure and proper spacing of the jaws, points essential to the natural appearance of the artificial teeth, as also to their comfort and utility. The two plates, while thus in the mouth, are then so marked upon the wax rims *b* that when withdrawn they may be replaced in precisely the same relation to each other. The double cast, technically termed the "articulator," Figure 2, is then formed upon them preparatory to the adjustment of the teeth upon the wax rim (*b*), which adjustment will require the removal, more or less completely, of said rims, the plates meanwhile being held securely in proper position by the "articulator." By this process the plate adapts itself with unerring accuracy to the teeth, whereby great expenditure of time, trouble and patience necessary in the articulation of teeth by other methods are saved where each tooth requires to be ground to fit the plate or base.

The teeth having been arranged, they are for greater security again tried in the mouth, and any slight changes necessary made, after which all superfluous wax is removed, leaving only so much as is designed to be replaced by metal in order to secure a plate of proper thickness for strength and durability and a firm retention of the teeth. The upper pattern plate is represented in section in Figure 5; this, if made rightly at first and carefully handled, will require no further alteration. In this Figure *c* represents the wax added or placed around the teeth, which, when replaced by the metal used for the formation of the plate or "base," will secure for them a strong attachment to the plate, and give to teeth thus mounted a superior cleanliness, as it furnishes no crevice or other place for lodgement of extraneous matters. The wax having been properly smoothed, and the slightest change in the position of the teeth carefully avoided, the pattern plate is placed upon the original cast A, Figure 5, and the other half of the matrix made by pouring the composition over it, in doing which care must be taken to fill every crevice between the teeth not occupied by wax. When hardened,
652 the two parts of the matrix are separated, and the foil and wax carefully removed, disregarding minute portions of the latter, which the matrix, when heated, will absorb. A gate (*d*) is then cut (see *d*, Figures 5 and 6), to give free access to the metal, with suitable vents whenever required for the escape of air or gas during the act of casting, after which the two parts of the matrix are closed and secured firmly together with binding wires (*e*), and the joints luted with composition similar to the matrix, except on the end containing the gate. The matrix thus prepared is then subjected for two or three hours to a dry heat, ranging from 250° to 350° Fahrenheit, which drives off the moisture (which otherwise would interfere with the flow of the molten metal) and absorbs such particles of wax as may have been too tedious or impossible to remove, and by gradually heating the teeth renders it impossible for the metal to fracture them, as so often happens under other processes.

The matrix thus heated is then ready to have the metal intended to form the base or plate poured into it, when the set will be completed, with the exception of the finishing process, which is substantially the same as in the old methods.

For the different varieties of work required the manipulations are substantially the same, and hence do not demand a separate description; but as an absolute & accurate fit to the mouth could not be obtained did the metal used for the purpose of forming the base or the material used in the formation of the matrix shrink or expand in solidifying or cooling,

I will now proceed to describe them, commencing with the matrix, which is composed of nearly equal proportions of plaster of Paris and feldspar. This compound enables the moulds to endure a certain amount of heat without shrinking or breaking, and at the same time sustain and give the exact characteristics of the impressions of the mouth, upon which depends the practical result of the operation, especially when taken in connection with the metal used in forming the plate or base of the teeth, which for the purpose of an accurate fit must not shrink or expand in solidifying on being cast, and yet possess sufficient hardness, strength, rigidity, and durability to render it suitable for the formation of dental plates.

A metal possessing such qualities I form by alloying in certain proportions, according to the strength and rigidity of the plate required, suitable metal, to be hereinafter named, in which the expansive property of one or more will counteract the tendency of the others
653 to shrink in cooling after being cast, as, for example, an alloy of this nature may be formed by combining tin, bismuth, antimony, and silver in the following proportions, to wit: Tin, ten to twenty parts; bismuth, one to five parts; antimony, one to two parts; and silver, one to two parts; to these might be added from five to fifteen parts of cadmium if a still greater strength and rigidity are required, as in cases of partial sets; or, for the same purpose, an alloy composed of tin, twenty to twenty-four parts; antimony, four to six parts; and silver, two to four parts, may be used. In these examples the expansive properties of bismuth and antimony on cooling are used to neutralize the shrinkage on the part of the other metals. These metals (bismuth and antimony) also serve, in conjunction with the silver & cadmium, to give that hardness, strength, and rigidity to the alloy which renders it suitable for forming the dental plate, the bismuth also acting in conjunction with the tin and cadmium when used to lower its melting point, great fusibility being an indispensable quality as well in the successful formation of the dental plates by the process of casting as in the repair of accidents and in the repair of mistakes. The plates, when completed, if desired, may be readily and durably coated with pure gold by the process known as electro-gilding; but, as a general rule, the plate, when made of the above-described alloys, will be worn pure, as it is almost devoid of all taste, and is not liable to tarnish or corrode by the secretions of the mouth. From the foregoing it will be apparent that these alloys may be slightly varied in their relative proportions in order to suit the circumstances of the case, without departing materially from the principle of my invention, or the metals themselves might be substituted by others possessing the same characteristic properties.

The matrix & the metal used for casting the plates, & the process by which an accurate fit to the mouth and correct articulation of the teeth are obtained, having been described, it is now only necessary to describe

the formation of the tooth, by which it is adapted to the process of casting, the object of which is so to encase the teeth with the metal that they shall virtually form but one piece, thus rendering it utterly impossible for a tooth to work loose or drop out. The teeth employed by me for this purpose are constructed with a channel (*f*) running vertically through them, into which a piece of wire of alloyed tin may be inserted if desired; altho' I frequently omit the use of such, merely permitting the metal of the base to flow in it. When the wire is used, it is
654 allowed to project at either end about $\frac{1}{16}$ of an inch, which, upon the metal being poured in the matrix to form the plate, secures the positive union or connection of the tooth with the plate. The outer end of this piece of wire may be afterwards fused by means of a blowpipe to make it a headed bolt, so as to rivet each tooth, as it were, to the plate.

In order to effect a more positive union of the teeth with the plate, a neck (*g*) and side projections are formed, which are perfectly encased by the metal, the neck and sides being so shaped as to act as a dovetail, thus rendering it impossible for the tooth to work loose or drop out, unless broken, or the plate by some accident ruptured. Or, the teeth may be formed with a dovetailed groove extending through the teeth, there being a vertical hole or channel formed in the teeth and connecting with the groove, or a channel may be formed around the exterior periphery of the tooth near its bottom, thus forming a species of a dovetail round which the metal flows, firmly securing the teeth to the plate, as the large end is imbedded in it. This process is also adapted to the securing of block teeth to the plate, which has the effect of rendering them more enduring, and at the same time giving to them a more elegant and finished appearance than by the old process. For this purpose the upper surface of the block is grooved and perforated (either in part or entirely) through with a series of holes, as shown in Figures 10 & 11, one for every tooth, for the reception of a fusible pin, which, being melted by the liquid metal as it is poured in the flask, ensures a perfect metallic connection between each with the plate. Around the upper edge of the block is accurately cut a narrow curvilinear channel, which forms the limit of the metal and another bond of connection between it and the plate, there being a similar groove for the same purpose in the rear side of the block. By these grooves the block is firmly secured, that is to say, dovetailed in the metal of the plate, thus rendering it at once strong and neat.

Having thus fully described my invention, what I claim as new, and desire to secure by letters patent, is,

First, moulding the plates or bases of artificial teeth in such a manner as to obtain accurate fit to the gums and a correct articulation of the teeth.

Second, I claim forming artificial teeth in the manner described so as to adapt them to the process of casting, as set forth.

Third, I claim a matrix composed of plaster of Paris and feld-
655 spar, in the proportions substantially as specified for the purposes set forth.

And, lastly, I claim casting the plates or "bases" of artificial teeth of an alloy suitable for such a purpose from its chemical & physical properties, which practically will not shrink or expand on solidifying or cooling, substantially as set forth.

In witness whereof, I, the said Alfred A. Blandy, have hereunto set my hand and seal this tenth day of August, A. D. 1857.

ALFRED A. BLANDY. [SEAL.]

We hereby certify the above (letter-press only) to be a true copy.
SAMUEL CASSERLEY,
H. A. CHEESWRIGHT,
Clerks in the Patent Office.

656 United States circuit court.

District of Massachusetts.

GOODYEAR DENTAL VULCANITE COMPANY and Josiah Bacon
vs.
DANIEL H. SMITH.

District of New Jersey.

SAME
vs.
CHARLES S. STOCKTON.

SAME
vs.
FRANK A. CUMMINGS.

District of Delaware.

SAME
vs.
ZENAS A. VANDEVENTER.

Eastern district of Pennsylvania.

SAME
vs.
ROBERT E. DIFENDERFER. } New suit. Bill filed Sept., 1873.

SAME
vs.
WILLIAM H. GATES. } New suit. Bill filed Sept., 1873.

657 SAME
vs.
WM. HARVEY ROOP. } New suit. Bill filed Sept., 1873.

SAME
vs.
GEORGE A. SINCLAIR. } New suit. Bill filed Sept., 1873.

It is stipulated and agreed that all proofs taken for final hearing in the above-entitled suit of Goodyear Dental Vulcanite Company et al. vs. Daniel H. Smith, shall be taken as the proofs for final hearing in each of the above-entitled causes. A printed copy of the proofs in said suit taken on behalf of each party, including documentary exhibits, shall be filed with the clerk of the court in each of above districts within ten days after the proofs are closed on behalf of such party, as the stipulated testimony in the above-entitled cause pending in said district,

and such testimony shall be read and used at the hearing of each of said causes, the same and with the same effect as if the same had been regularly and duly taken in each of said causes separately. Within the same period of ten days ten copies of the defendant's proofs shall be delivered to Lee & Alvord, of New York, for the use of the complainants, and within the same time, ten copies of complainants' proofs shall be delivered to Henry Baldwin, jr., esq., of Philadelphia, for the use of the defendant. Said suit vs. Smith shall be placed on the calendar for the October term, 1873, and shall be brought to final hearing before the circuit judge of the first circuit at the earliest day that he will appoint, not less than thirty days after the printed proofs on both sides are interchanged as above provided, and at any place within said circuit that said judge may designate; the party proposing to apply for such appointment to give seasonable previous notice to the opposite party of the time and place which are proposed in the application to be made for such appointment. None of the causes above entitled shall be brought to hearing on pleadings and proofs, or otherwise, until after the said Smith suit shall have been decided.

All proceedings in said causes shall be had under due notices, to be served only upon and by Lee & Alvord for complainants, and upon
658 and by Henry Baldwin, jr., for defendants. Said testimony may be taken before Aubrey H. Smith, esq., of Philadelphia, Kenneth G. White, esq., of New York, or John G. Stetson, esq., of Boston, who are hereby agreed upon as special examiners for that purpose. It is understood that the printed copies of the proofs already taken by the complainants may be filed and served within ten days after the signing of this stipulation.

Dated September 30th, 1873.

(Signed) LEE & ALVORD,
Sol'rs for compl'ts in suits vs. Smith, Stockton, and Cummings.
J. E. SHAW,
Sol'r for compl'ts in suits vs. Difenderfer, Gates, Roop, and Sinclair.
SAMUEL M. HARRINGTON,
Sol'r for compl'ts in suit vs. Vandeventer.

659 The United States Patent Office, to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the letters patent granted Nelson Goodyear, dated May 6th, 1851, No. 8075, for "Improvement in Manufacture of India rubber."

In testimony whereof, I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this eleventh day of October, in the year of our Lord one thousand eight hundred and seventy two, and of the Independence of the United States the ninety-seventh.

[L. S.] J. M. THACHER,
Acting Commissioner.

No. 8075.

The United States of America to all to whom these letters patent shall come:

Whereas, Nelson Goodyear, of New York, N. Y., has alleged that he has invented a new and useful improvement in the manufacture of India rubber, which he states has not been known or used before his applica-

tion; has made oath that he is a citizen of the United States; that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are therefore to grant, according to law, to the said Nelson Goodyear, his heirs, administrators or assigns, for the term of fourteen years from the sixth day of May, one thousand eight hundred and fifty-one, the full and exclusive right and liberty of making, constructing, using and vending to others to be used, the said improvement, a
660 description whereof is given in the words of the said Goodyear, in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand at the city of Washington, this sixth day of May, in the year of our Lord one thousand eight hundred and fifty-one, and of the Independence of the United States of America the seventy-fifth.

J. J. CRITTENDEN,
Acting Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[L. S.] THOS. EWBANK,
Commissioner of Patents.

The schedule referred to in these letters patent, and making part of the same.

To whom it may concern:

Be it known that I, Nelson Goodyear, of the city, county and State of New York, have invented a new and useful improvement in the preparation and manufacture of caoutchouc, or India rubber; and I do hereby declare that the following is a full and exact description thereof.

The nature of my invention consists in so compounding caoutchouc with other substances that the composition thus formed, when subjected to the heating or curing process described in the patent of Charles Goodyear, dated June 15th, 1844, and in the reissue of said patent, dated December 25th, 1849, will form a hard, stiff substance, hitherto unknown.

The need of some such substance in several branches of the India-rubber manufacture first called my attention to the subject, and experiments were commenced by me for the pupose of ascertaining whether caoutchouc could not be so treated as to be rendered comparatively hard and stiff. My efforts were, after repeated trials, at least successful, and the result, so far as then ascertained, was communicated in a caveat, filed in the Patent Office, and dated December, 1849. Further experiments made by me since the filing of that caveat have confirmed the entire success of my invention.

To enable others skilled in the manufacture of caoutchouc to understand and use my invention, I will proceed to describe the process: The indispensable ingredients used in my composition are caoutchouc
661 and sulphur, and when only these two ingredients are used, the best proportion will be about equal parts by weight of each of

them; indeed, a much less proportion of sulphur will not suffice. But though the combination of so large a proportion of sulphur with the caoutchouc will produce, when cured, a hard substance, a still better result will be obtained by the introduction of magnesia, lime, carbonate of magnesia or lime, or sulphate of magnesia or lime into the composition, in which case the following proportion will be found a highly advantageous one, viz, one pound of caoutchouc, half a pound of sulphur, and half a pound of magnesia or lime, or carbonate of magnesia or lime, or sulphate of magnesia or lime.

The proportions specified in both of these compounds may be considerably varied without materially changing the result; but in no case will a much less quantity of sulphur than four ounces to every pound of caoutchouc be sufficient, in which respect particularly my compounds differ very essentially from every other composition of India rubber in use; as in all other rubber compositions the least quantity of sulphur that will suffice to cure the article is aimed at. With either of these compounds first described, gum lac (or gum shellac) may be combined to great advantage, say in the proportion of from four to eight ounces of gum lac to every pound of caoutchouc. Rosin, oxides or salts of lead, or zinc of all colors, and other similar substances, both mineral and vegetable, may be added in small quantities to either of the compounds for the purposes of polish, color, making the mixture work more easily, etc., no precise rule for which can be given, or is necessary, as the operator will easily discriminate.

The ingredients may be mixed and incorporated with one another in the usual methods employed in the manufacture of compounds of caoutchouc. When mixed, the compound may be either rolled into sheets by means of calendering rollers, or formed by moulding, or other well-known processes, into any desired shape, for the purpose of being used in the manufacture of such articles as the same may be applicable to. The compound must then be subjected to the heating or curing process already mentioned, as patented by Charles Goodyear, and to which reference is hereby made for a particular description thereof; in most cases the heat will be required to be raised as high as 260° or 275° Fahrenheit, and the time of exposure to the heat will range from three to six hours, or even longer.

When it is desired to use the hard substance formed by my compounds with the common vulcanized rubber goods, they should be attached to another before either is cured, and then cured together.

I do not claim the heating or curing process, as it is termed, that having been patented by Charles Goodyear.

What I do claim as my invention, and desire to secure by
662 letters patent, is "the combining of India rubber and sulphur, either with or without shellac, for making a hard and inflexible substance, hitherto unknown, substantially as herein set forth."

And I also claim "the combining of India rubber, sulphur, and magnesia or lime, or a carbonate or a sulphate of magnesia or of lime, either with or without shellac, for making a hard and inflexible substance, hitherto unknown, substantially as herein set forth."

NELSON GOODYEAR.

NEW YORK, *December* 26, 1850.

Witnesses:

SALLIE F. ELLIOT.

WM. H. ELLIOT, Jr.

663 The United States Patent Office, to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the reissue letters patent granted Henry B. Goodyear, administrator, dated May 18th, 1858, No. 556, for "improvements in the manufacture of India rubber.

In testimony whereof, I, J. M. Thacher, acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this sixteenth day of October, in the year of our Lord one thousand eight hundred and seventy-two, and of the Independence of the United States the ninety seventh.

[L. S.] J. M. THACHER,
Acting Commissioner.

Reissue No. 556.

The United States of America, to all to whom these letters patent shall come:

Whereas Henry B. Goodyear, of New York, N. Y., administrator of the estate of Nelson Goodyear, deceased, late of said New York, has alleged that said Nelson Goodyear did (in his lifetime) invent a new and useful improvement in the manufacture of India rubber (for which letters patent were issued to said Nelson Goodyear, dated May 6th, 1851, which letters having been surrendered by the said administrator, the same have been canceled, and separate letters ordered to issue to him on two amended specifications), which said Nelson Goodyear stated had not been known or used before his application; had made oath that he was a citizen of the United States; that he did verily believe that he was the original and first inventor or discoverer of the said improvement, and that the same had not, to the best of his knowledge and belief, been previously known or used; said Henry B. Goodyear having paid into the Treasury of the United States the sum of fifteen dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are therefore to grant, according to law, to the said Henry B. Goodyear, administrator as aforesaid, his administrators or assigns, for the term of fourteen years from the sixth day of May, one thousand eight hundred and fifty-one, the full and exclusive right and liberty
664 of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Henry B. Goodyear, in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand, at the city of Washington, this eighteenth day of May, in the year of our Lord one thousand eight hundred and fifty-eight, and of the Independence of the United States of America the eighty-second.

JACOB THOMPSON,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.

[L. S.] J. HOLT,
Commissioner of Patents.

The schedule referred to in these letters patent, and making part of the same.

To all to whom these presents shall come:

Be it known that I, Nelson Goodyear, late of the city, county, and State of New York, now deceased, did, in his lifetime, invent a new and useful improvement in the preparation and manufacture of caoutchouc, producing thereby a substance not before known, for which said invention letters patent of the United States were granted to the said Nelson Goodyear, bearing date the 6th day of May, 1851.

That the said letters patent are believed to be inoparative by reason of a defective and insufficient description and specification, which defects and insufficiencies have arisen from inadvertence and mistake, and without any fraudulent intention.

And that the following is a full, clear, and exact description of the said invention, distinguishing it from all other things before known, and of the manner of working the same, so as to enable any one skilled in the art of vulcanizing India rubber or other allied gums to work the said process, and produce the said substance or manufacture, and use the same. The invention of the said Nelson Goodyear relates to an improvement in the process of preparing India rubber and other vulcanizable gums, described in letters patent reissued to Charles Goodyear on the 25th day of December, 1849, on the surrender of letters patent granted to him by the United States, and bearing date the 15th day of June, 1844, by which said improved process a new substance is
665 produced very distinct in character from the substance produced by the said invention of Charles Goodyear, and applicable to different purposes.

The object of the said Nelson Goodyear was to produce from caoutchouc a substance or manufacture possessing preperties suitable to making, by moulding or otherwise, a great variety of articles used in the arts, and which, prior to his said invention, could only be wrought at great expense, of ivory, bone, tortoise-shell, horn, whalebone, and other like substances.

He was aware that by the vulcanizing process invented by and patented to Charles Goodyear on the 15th day of June, 1844, and reissued on an amended specification bearing date the 25th day of December, 1849, a new substance was produced by subjecting India rubber or allied gums and sulphur (and occasionally other ingredients) in admixture to a high degree of artificial heat, and that this new substance so produced possessed, in addition to the valuable natural properties of the native gum or gums, improved new properties valuable in the arts. But although many of these properties were considered by the said Nelson Goodyear important to be possessed by the material which he desired to produce, yet as the product of the invention of Charles Goodyear was soft and pliable, and only elastic when stretched or compressed, it was obvious that although eminently useful for the uses contemplated by the inventor, Charles Goodyear, such as wearing apparel, car springs, door-springs, packing for steam joints, etc., where pliability and its other qualities were important, it was wholly unsuited to the purposes contemplated by the said Nelson Goodyear from the want of the hardness and beauty, when finished, of the ivory and the other substances named, and of the spring-like property under flexure peculiar to whalebone. In view of the properties desired and the manner of production, the improvement of the said Nelson Goodyear consists in thoroughly mixing India rubber or other vulcanizable gum with sulphur, whether with or

without auxiliary ingredients, in the proportion of about from four ounces to a pound of sulphur to a pound of the gum, and then subjecting the same to a high degree of artificial heat, as in the said vulcanizing process of Charles Goodyear, until the compound shall have acquired the required hard and tough property found in various degrees in ivory, bone, tortoise-shell and horn, and the spring-like property, under flexure, found in whalebone.

To enable any one skilled in the art of vulcanizing caoutchouc to work the said invention of Nelson Goodyear, I will describe the mode of procedure.

The India rubber, or any of the allied gums which are known to be vulcanizable by the before named process of Charles Goodyear, is thoroughly mixed with sulphur, as for the well-known vulcanizing process, but in different proportions, as in the working of the said vulcanizing process of the said Charles Goodyear. The best results are obtained by the use of the smallest proportional quantity of sulphur, which will suffice to produce the change termed vulcanization, and which is usually not over one ounce of sulphur to a pound of gum, while so small a proportional quantity of sulphur would entirely fail of producing the result obtained by the improved process of the said Nelson Goodyear.

666

After the gum and sulphur have been thoroughly incorporated, and while the compound is in a plastic state, it may be rolled into sheets or put into any form desired by mounding or otherwise, and then, whether in moulds or otherwise, subjected to a high degree of heat, which should not be less than from 260° to 275° of Fahrenheit's scale, in a steam or other heater, and kept there about six hours or more—that is, until the compound substance has attained the required degree of hardness.

And although India rubber or other allied gum and sulphur in suitable proportions will produce the new manufacture or substance suited to a great variety of purposes, and which will be capable of receiving the highest degree of polish, a still cheaper, and for many purposes a better substance will be produced by the addition of other ingredients, such as magnesia, or of lime, or of carbonate of magnesia or of lime, or the sulphate of magnesia or of lime, in which case the mixture may be made in the proportion of one pound of gum to a half pound of sulphur, and a half a pound of either of the other ingredients named. And, in short, with the view to economy, and to vary the texture in degree and to impart various colors, other ingredients may be incorporated, such as gum lac (gum shellac), resin, oxides or salts of lead or zinc, and other similar substances, whether mineral or vegetable. If gum lac be introduced, it should be in the proportion of from four to eight ounces to the pound of India rubber or allied gum.

The various additional or auxiliary ingredients only affect the product in degree, as the character of the new manufacture or substance is dependent upon the use of caoutchouc and a sufficient proportional quantity of sulphur, and a sufficiently high degree of heat continued long enough to induce the change indicated. And although much latitude may be taken in the proportional quantity of sulphur, a proportion much less than four ounces to the pound of caoutchouc will utterly fail to produce the new substance or manufacture herein above described.

It is well known that it has been proposed to produce a hard substance from caoutchouc by passing it through highly-heated liquid sulphur; but this has not been attended with practical success.

I do not wish to be understood, however, as making claim broadly to

the union of caoutchouc and sulphur in the proportions named, however these substances may be united and treated.

667 But what I do claim as the invention of the said Nelson Goodyear, and desire to secure by letters patent, is the combining of sulphur and India rubber or other vulcanizable gum, in proportions substantially as specified, when the same is subjected to a high degree of heat, substantially as specified, according to the vulcanizing process of Charles Goodyear, for the purpose of producing a substance or manufacture possessing the properties or qualities substantially such as described; and this I claim, whether the said compound of sulphur and gum be or be not mixed with the other ingredients as set forth.

H. B. GOODYEAR,
Administrator of Nelson Goodyear, deceased.

Witnesses:
WM. BISHOP.
WM. C. BROWN.

668 The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the reissue letters patent granted Henry Goodyear, administrator, dated May 18th, 1858, No. 557, for "improvement in the manufacture of India-rubber."

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this sixteenth day of October, in the year of our Lord one thousand eight hundred and seventy-two, and of the Independence of the United States the ninety-seventh.

[L. S.] J. M. THACHER,
Acting Commissioner.

Reissue No. 557.

The United States of America to all to whom these letters patent shall come:

Whereas Henry B. Goodyear, of New York, N. Y., administrator of the estate of Nelson Goodyear, deceased, late of said New York, has alleged that the said Nelson Goodyear did (in his lifetime) invent a new and useful improvement in the manufacture of India rubber (for which letters patent were issued to said Nelson Goodyear, dated May 6th, 1851, which letters having been surrendered by the said administrator, the same have been canceled, and separate letters ordered to issue to him on two amended specifications), which said Nelson Goodyear stated had not been known or used before his application; and made oath that he was a citizen of the United States; that he did verily believe that he was the original and first inventor or discoverer of the said improvement, and that the same had not, to the best of his knowledge and belief, been previously known or used; said Henry B. Goodyear having paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose.

These are therefore to grant, according to law, to the said Henry B. Goodyear, administrator as aforesaid, his administrators or assigns for the term of fourteen years from the sixth day of May, one thou-

669 sand eight hundred and fifty-one, the full and exclusive right and

liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Henry B. Goodyear, in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand at the city of Washington this eighteenth day of May, in the year of our Lord one thousand eight hundred and fifty-eight, and of the Independence of the United States of America the eighty-second.

JACOB THOMPSON,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[L. S.]
J. HOLT,
Commissioner of Patents.

The schedule referred to in these letters patent and making part of the same.

To all to whom these presents shall come:

Be it known that Nelson Goodyear, late of the city, county, and State of New York, now deceased, did, in his lifetime, invent a new and useful improvement in the preparation and manufacture of caoutchouc, and did thereby produce a new manufacture or substance, for which said invention letters patent of the United States were granted to the said Nelson Goodyear, bearing date the 6th day of May, 1851.

That the said letters patent are believed to be inoperative by reason of a defective and insufficient description and specification, which defects and insufficiencies have arisen from inadvertence and mistake, without any fraudulent intention.

And that the following is a full, clear, and exact description of the said new manufacture or substance, distinguishing it from all other things before known, and of the manner of making the same in such full, clear, and exact terms, as to enable any one skilled in the art of vulcanizing India-rubber and other allied gums, to make, produce, and use the same.

The invention of the said Nelson Goodyear relates to an improvement in the preparation of what is known as vulcanizable India-rubber and allied gums, described in letters patent reissued to Charles Good-
670 year on the 25th day of December, 1849, on the surrender of letters patent granted to him by the United States, and bearing date the 15th day of June, 1844, by which said improvement a new substance is produced never before known, and applicable to purposes to which the products of the said Charles Goodyear's invention are wholly inapplicable.

The object of the said Nelson Goodyear was to produce from India-rubber, or other vulcanizable gums, a substance or manufacture possessing properties suitable for making (by moulding or otherwise) a great variety of articles used in the arts, and which, prior to said invention, could only be wrought, at great expense, of ivory, bone, tortoise-shell, horn, whale bone, and other like substances.

He was aware that, by the vulcanizing process invented by and patented to Charles Goodyear on the 15th day of June, 1844, and reissued on an amended specification bearing date the 25th day of December, 1849, a new substance was produced by subjecting India-rubber, or allied

gums, and sulphur (and occasionally other ingredients), in admixture, to a high degree of artificial heat, and that this new substance so produced possessed, in addition to the valuable natural properties of the native gum or gums, improved new properties, valuable in the arts. But, although many of these properties were considered by the said Nelson Goodyear important to be possessed by the material which he desired to produce, yet, as the product of the invention of Charles Goodyear was soft and pliable, and only elastic when stretched or compressed, and although eminently useful for the uses contemplated by the inventor, Charles Goodyear, such as wearing apparel, car and door-springs, packing for steam-joints, etc., where pliability and its other qualities were important, it was obvious that it was wholly unsuited to the purposes contemplated by the said Nelson Goodyear from the want of hardness and beauty, when finished, of the ivory and other substances named, and of the spring-like property under flexure peculiar to whalebone.

In view of the properties desired and the manner of production, the invention of the said Nelson Goodyear consists of the production of a new manufacture, or artificial substance, having the hard and tough properties found in various degrees in ivory, bone, tortoise shell, and horn, and the spring-like property under flexure of whalebone, and which in the process of manufacture is plastic, so that it can be moulded or modled with facility into any desired shape, and which, when completed, may be wrought and polished to as high a degree as any of the native substances for which it is a substitute; which said manufacture or artificial substance is produced by the admixture of India rubber or other vulcanizable gums and sulphur, in the proportions of one
671 pound of the gum to about from four ounces to a pound of sulphur, whether alone or with other substances, and then subjected to a high degree of heat, which should not be less than from 260° to 275° Fahrenheit's scale, during a period of six or more hours, or until the required degree of hardness has been obtained.

To enable any one skilled in the art of vulcanizing caoutchouc to produce the said manufacture or substance, I will describe the mode of procedure.

The India rubber, or any of the allied gums which are known to be vulcanizable by the before-named process of Charles Goodyear, is thoroughly mixed with sulphur, as for the well-known vulcanizing process; but in different proportions, as in the working of the said vulcanizing process of the said Charles Goodyear the best results are obtained by the use of the smallest proportional quantity of sulphur which will suffice to produce the change termed vulcanization, and which is usually not over one ounce of sulphur to a pound of gum, while so small a proportional quantity of sulphur would entirely fail of producing the results obtained by the improved process of the said Nelson Goodyear.

After the gum and sulphur have been thoroughly incorporated, and while the compound is in a plastic state, it may be rolled into sheets, or put into any form desired, by moulding or otherwise, and then, whether in moulds or otherwise, subjected to a high degree of heat, which should not be less than from 260° to 275° Fahrenheit's scale, in a steam or other heater, and kept there about six hours or more, that is, until the compound substance has attained the required degree of hardness.

And, although India rubber, or other allied gum, and sulphur in suitable proportions, will produce the new manufacture or substance, suited to a great variety of purposes, and which will be capable of receiving

the highest degree of polish, a still cheaper, and, for many purposes, a better substance will be produced by the addition of other ingredients, such as magnesia or lime, or the carbonate of magnesia or of lime, or the sulphate of magnesia or of lime, in which case the mixture may be made in the proportion of one pound of gum to half a pound of sulphur, and a half a pound of either of the other ingredients named, and in short, with the view to economy, and to vary the texture in a degree and to impart various colors, other ingredients may be incorporated, such as gum lac (gum shellac), resin, oxides or salts of lead, of zinc, and other similar substances, whether mineral or vegetable. If gum lac be introduced, it should be in the proportion of from four to eight ounces to the pound of India rubber or allied gum.

The various additional or auxiliary ingredients only affect the product in degree, as the character of the new manufacture or substance is dependent upon the use of caoutchouc, and a sufficient proportional quantity of sulphur and a sufficiently high degree of heat continued long enough to induce the change indicated.

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And although much latitude may be taken in the proportional quantity of sulphur, a proportion much less than four ounces to the pound of caoutchouc will utterly fail to produce the new substance or manufacture herein above described.

I do not wish to be understood as making claim broadly to a manufacture or substance produced by the admixture of caoutchouc and sulphur, nor as making claim broadly to a manufacture or substance by subjecting the compound of caoutchouc and sulphur, whether with or without other substances, to a high degree of heat, as, prior to the invention of the said Nelson Goodyear, caoutchouc and sulphur had been compounded, and such compound alone, as well as with other ingredients, had been subjected to a high degree of heat, but not to produce the manufacture or substance having the character peculiar to the said manufacture or substance invented by the said Nelson Goodyear.

What is claimed as the invention of the said Nelson Goodyear, deceased, and desired to be secured by letters patent, is the new manufacture or substance herein above described, and possessing the substantial properties herein described, and composed of India rubber, or other vulcanizable gum, and sulphur, in the proportions substantially such as described, and, when incorporated, subjected to a high degree of heat, as set forth; and this I claim, whether other ingredients be, or be not, used in the preparation of the said manufacture as herein described.

H. B. GOODYEAR,
Administrator of Nelson Goodyear, deceased.

Witnesses:
WM. H. BISHOP.
WM. C. BROWN.

673 The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy, from the files of this office, of the file wrapper and contents in the matter of the letters patent granted Charles Goodyear, dated April 12th, 1853, No. 9668, for "Improvement in manufacturing gutta-percha and India rubber."

In testimony whereof, I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this third day of May, in the year of our Lord one thousand eight hun-

dred and seventy-three, and of the Independence if the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

In the matter of Charles Goodyear's application for letters patent for an improvement in the manufacture of objects composed of caoutchouc or gutta percha, or other gums, or their compounds. Before the Hon. Commissioner of Patents.

STATE OF NEW YORK,
City and County of New York, ss:

I, Charles Goodyear, of New Haven, in the State of Connecticut, do depose and say that letters patent were granted in England to Newton, as a communication from a foreigner residing abroad, sealed on the 4th day of March, 1851, and the specification enrolled on the 4th of September, 1851, for improvements in the preparation of materials applicable to the manufacture of buttons, knife-handles, inkstands, door-knobs, and other articles where hardness, strength and durability are required.

That the invention so communicated to the said Nowton was the invention of deponent, and by him communicated to said Newton.

That the said letters patent were obtained by the said Newton, and are held in trust for deponent.

And that amongst other things in the said letters patent, is described and claimed the invention described in the within specification,
674 for which deponent prays that letters patent of the United States may be granted unto him.

CHARLES GOODYEAR.

Subscribed and sworn to before me this 25th day of June, A. D. 1852.

WM. G. STERLING,
Commissioner of Deeds.

STATE OF NEW YORK,
City and County of New York, ss:

On this 25th day of June, A. D. 1852, before me, a commissioner of deeds, personally appeared the within-named Charles Goodyear and Robert Haering, and made oaths that they verily believe themselves to be the original and first inventors of the within-described improvement in the manufacture of objects composed of caoutchouc or gutta-percha, or other gums and their compounds, and that they do not know or believe that the same was ever before known or used, and that they are citizens of the United States.

WM. G. STERLING,
Commissioner of Deeds.

To the Hon. Commissioner of Patents:

The petition of Charles Goodyear and Robert Haering, both of New Haven, Connecticut, respectfully represents—

That they have invented certain new and useful improvements in the manufacture of objects composed of caoutchouc or gutta-percha, or other gums and their compounds, which they verily believe have not been known or used prior to the invention thereof by your petitioners.

They therefore pray that letters patent of the United States may be

granted to Charles Goodyear, as the sole assignee of all your petitioners' right, title and interest therein and thereto, vesting in him and his legal representatives the exclusive right to the same, upon the terms and conditions expressed in the act of Congress in that case made and provided, your petitioners having paid thirty dollars into the Treasury of the United States, and otherwise complied with the requirements of said act.

And he hereby authorizes A. P. and C. Brown (in connection with C. M. Keller as counsel) to act as his attorneys in presenting this application, altering or withdrawing the same as the case may require, and to receive the patent when granted.

CHARLES GOODYEAR.
ROBERT HAERING.

675 To all to whom these presents shall come:

Be it known that we, Charles Goodyear and Robert Haering, of New Haven, in the State of Connecticut, have invented a certain new and useful improvement in the manufacture of objects composed of caoutchouc or gutta-percha, or other gums of their compounds, and that the following is a full, clear, and exact description thereof.

The method of forming or shaping caoutchouc and its compounds in metal moulds, and subjecting the compounds while in the moulds to a high degree of artificial heat, is expensive and troublesome; and because they do not permit the escape of gases, a great many moulds or forms are necessary, requiring a considerable preliminary outlay. A great deal of manipulation and handling is requisite in using them; they require a large space, are difficult of transportation, and are liable to get easily out of repair; and what is still more important, the metal moulds do not permit the free escape of the gases evolved from the substances under treatment by the heat.

So important are these and some other objections to the use of metal moulds, that many articles of caoutchouc manufacture, which would be made if these objections did not exist, lie undeveloped for the want of some simple, easy, and economical process of forming or shaping or keeping or holding the shape of the articles while they are being heated or vulcanized.

By our improved method we are enabled to manufacture a great variety of articles of caoutchouc or its compounds which could not before be made, and to manufacture other articles with greater facility and economy than before.

Our invention consists in using or employing sand, pulverized soapstone, plaster, or some similar granular or pulverized, and, when put together, porous matter or moulds made of porous substances, to sustain and keep the form of moulded or modeled articles composed of caoutchouc or its compounds, and other gums susceptible of vulcanization, during the process of heating or vulcanization.

We have discovered that moulding in previously the third of cold . has the effect of making articles made of caoutchouc, gutta-percha, etc., prepared for vulcanization, so that articles which would otherwise be made up produced of the most style.

And our invention also consists in producing articles of vulcanized caoutchouc, gutta-percha, etc., of light colors, such as drab, by simply moulding or putting the said caoutchouc, etc., into moulds previously heated, and then subjecting such articles to artificial heat for curing or vulcanization.

We take articles composed of compounds of caoutchouc, or other gums susceptible of vulcanization, in the green state.

We cause them to be pressed or otherwise formed into the
676 exact shapes which they are required to have after being vulcanized. We then cover the surface of the articles with pulverized soapstone or plaster, or other similar non-adhesive powder. We then place the articles in a box filled with sand, the finer the sand the better, or pulverized soapstone or other similar equivalent granular or pulverized matter, so that each article shall be completely surrounded and covered by the sand or pulverized soapstone or plaster, etc., and imbedded in the same, and thereby sustained.

When it is desired to give a very smooth surface to the article, we cause it to be completely surrounded with a layer of soapstone, even though sand may be employed about the layer of soapstone. We sometimes use moist sand or pulverized soapstone.

When the articles are thus properly placed in the box, we subject the sand or other material to pressure, so that the box shall be solidly filled; we then, by means of a cover, or sometimes by pressure, confine the sand or other material, so that the articles shall be at all times in contact with and pressed upon by the sand or other material during the process of heating.

We then place the articles thus surrounded with and sustained by sand or pulverized soapstone or other material in an oven or heater, and subject the same to a high degree of artificial heat, moist or dry heat, say from 260° to 300° Fahrenheit, for a period of from three to seven hours, and upon taking the articles out of the sand or other material, the articles will be found to be vulcanized in the same form in which they were when put into the sand.

We are thus enabled to produce economically a great variety of objects; among them, embossed or indented, or plain sheets, or plates, or masses of regular or irregular forms, convex or concave, such as pieces of furniture, book-covers, buttons, toys of various kinds, etc.

Or we make the mould of plaster of Paris, best calcined, or other substance which when dried will be porous and permit the escape of gases evolved from the matter under treatment, and all contained air, and thereby prevent the expansion of confined air and other gases from injuring the surface of the moulded substance.

Or we mould the article in a mould which is to produce the figure, and pack in sand or pulverized soapstone or other like granular or pulverized substance, to support the other surface or surfaces of the article to be produced, and thus keep the face which is to be figured in contact with the partial mould of metal or plaster or other material, and thus afford a free discharge for air and gases, whilst at the same time the moulds are greatly cheapened.

The moulds or outer casing may be made of glass instead of iron or other metal.

But we prefer the first mode of procedure, as it avoids entirely
677 the use of moulds during the process of vulcanization, the sand or other pulverized or granular material having the effect thoroughly to support and retain the form previously given to the article by moulding or modeling.

When we wish to produce articles of drab or other light and delicate color among the articles of caoutchouc properly prepared for vulcanization in moulds made of calcined plaster of Paris, previously heated to about 150° Fahrenheit in accordance with our new discovery, and then subject it to the vulcanizing process in the usual way. Thus

vulcanized articles of caoutchouc or gutta-percha or the compounds thereof can be produced of delicate colors. This mode of procedure being a bending instead of a darkening effect.

The prepared caoutchouc, gutta-percha, etc., if it is to be imbedded in moistened plaster, should be previously varnished; and to keep the surface of such articles to be thus vulcanized in sand, smooth India paper should be interposed between such surface and the sand.

Having thus fully described the nature of our invention,

What we claim and desire to secure by letters patent is the art or method of manufacturing articles composed in part of caoutchouc, or other gums susceptible of vulcanization, by heating or vulcanizing the same when surrounded with and pressed upon externally or internally by, or moulded in, pulverized soapstone, sand, plaster, or other similar granular, pulverized, or porous matter, or in moulds of plaster or other porous substances, substantially as herein described.

And we also claim as a means of producing articles composed in part of caoutchouc, or other gum susceptible of vulcanization, of light colors, such as drab, by moulding in previously heated moulds, and then subjecting the same to the process of vulcanization by heat, substantially as described.

CHARLES GOODYEAR.
ROBERT HAERING.

Witnesses:
JOSEPH H. DORR.
JAMES H. DORR.

Charles Goodyear and Robert Haering. Specialties referring to this case are marked No. 3. Frame and powder flasks relate back to March 4th, 1851, because of English patent granted to Newton for Goodyear.

UNITED STATES PATENT OFFICE,
December 28th, 1852.

SIR: The claims of your application for alleged improvements in the manufacture of India rubber compounds have been duly examined. The devices of the first claim are believed to present a patentable novelty, and the claim will probably be admitted. The device of the second claim has not been sufficiently described that the office can see
678 what is the ground of the claim. What is the heating of the mould before the experiment for? What does it do, that you claim letters patent therefor? You speak of it in connection with light colors. How does it act; and how does it contribute to preserve the colors light? The specification is returned herewith.

CHARLES GOODYEAR,
A. P. & C. BROWNE,
New York, N. Y.

NEW YORK, *March 12th*, 1853.

Hon. H. S. HODGES, Commissioner of Patents:

SIR: I have the honor herewith to resubmit the specification of Mr. Charles Goodyear's application for letters patent for improvements in the manufacture of India rubber compounds, which was returned for amendment on the 28th of December last. The specification has been amended as required.

As to the effect of moulding in previously heated moulds, the fact only can be stated. It has been thoroughly tested; but the rationale

cannot be given, as neither Mr. Goodyear nor his co-inventor have been able to ascertain it. They have discovered and tested the fact, and for it claim a patent. The reason of this strange result they must leave to future inquiry.

The clear statement of the fact was accidentally omitted in the specification.

I have the honor to be, yours, very respectfully,

CHAS. M. KELLER,
Of Counsel.

UNITED STATES PATENT OFFICE,
March 22d, 1853.

SIR: The specification of your application for a patent for alleged improvements in method of treating mixtures of rubber and percha during vulcanization, is again returned to you for further consideration. There is still a doubt left with regard to the subject of the process covered by your second claim being clearly embraced in the same invention as that designed to be covered by the first claim. As presented in the claims, you cover two specific processes or modes of vulcanizing under one patent. This is inadmissible. The details of the second claim the office cannot see embraced in the process covered by the first claim. It must be so embraced, or else one of the claims abandoned in this application. You have only sent one kind of specimens. Have you not two kinds—as shown in the two claims

Charles Goodyear and Robert Haering.

C. M. KELLER,
New York, N. Y.

679 NEW YORK, *March 28th*, 1853.

Hon. COMMISSIONER OF PATENTS:

SIR: Your letter of the 22d inst. has been received, with the specification of Messrs. C. Goodyear and Robert Haering's improved method of treating or manufacturing objects composed of India rubber, etc.

On a careful review of the matter, it is deemed best to confine the present application to the first claim, reserving the right to make the second claim the subject of a separate application.

The specification which is herewith returned has been so amended as to limit it entirely to the subject of the first claim.

I have the honor to remain, very respectfully,

CHAS. M. KELLER,
For C. Goodyear and Robert Haering.

P. S.—It will be observed, by reference to the affidavit appended, that this invention has been patented in England and that the patent then must relate back.

2144 No. 3.

No. 9 68. (3) SEPTEMBER 3D, 1852.

Charles Goodyear and Robert Haering, assignees to Charles Goodyear, of New Haven, county of New Haven, State of Connecticut.

Manufactures composed of caoutchouc or gutta percha, etc.

Received September 2d, 1852.

Petition, " "
Affidavit, " "
Specification, " "

3 drawing, } Sept. 3d, 1852, spec.
Model, }
1 cert. dep. $30, Sept. 2d, 1852.
Cash.
2 examined, L. D. Gale, March 21st, 1853.
Issue, R. C. W., " 29th, "
Patented April 12th, 1853.
Patented in England March 4th, 1851.
Recorded vol. 51, page 317.
For date of English patent, see specn.
Ass. recorded S 2, page 88.
On
C. A. P. & C. BROWN, New York.

Reported to exam. December 23d, 1852.
Rt'd spec. for cl. 2d, " 28th, "
Reported to exam. March 16th, 1853.
Rt'd spec. for cls. to be explained March 22d, 1853.

680 The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the letters patent granted Charles Goodyear, dated April 12th, 1853, No. 9668, for "Improvement in manufacturing gutta-percha and India rubber."

In testimony whereof, I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this twenty-fourth day of April, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

[L. S.] J. M. THACHER,
Acting Commissioner.

No. 9668.

The United States of America to all to whom these letters patent shall come:

Whereas Charles Goodyear and Robert Haering, of New Haven, Connecticut, have alleged that they have invented a new and useful improvement in manufacturing gutta-percha and India rubber (they having assigned their right, title, and interest in said improvement to Charles Goodyear, of New Haven, aforesaid), which they state has not been known or used before their application; have made oath that they are citizens of the United States; that they do verily believe that they are the original and first inventors or discoverers of the said improvement, and that the same hath not, to the best of their knowledge and belief, been previously known or used; have paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose.

These are therefore to grant, according to law, to the said Charles Goodyear, his heirs, administrators, or assigns, for the term of fourteen years from the fourth day of March, one thousand eight hundred and fifty-one, the full and exclusive right and liberty of making, construct-

ing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Goodyear
681 and Haering, in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand, at the city of Washington, this twelfth day of April, in the year of our Lord one thousand eight hundred and fifty-three, and of the Independence of the United States of America the seventy-seventh.

R. McCLELLAND,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[L. S.] R. C. WEIGHTMAN,
Acting Commissioner of Patents.

The schedule referred to in these letters patent, and making part of the same.

To all to whom these presents shall come:

Be it known that we, Charles Goodyear and Robert Haering, of New Haven, in the State of Connecticut, have invented a certain new and useful improvement in the manufacture of objects composed of caoutchouc or gutta percha or other gums, or their compounds, and that the following is a full, clear, and exact description thereof.

The method of forming or shaping caoutchouc and its compounds in metal moulds and subjecting the compounds while in the moulds to a high degree of artificial heat is expensive and troublesome, and because they do not permit the escape of gases.

A great many moulds or forms are necessary, requiring a considerable preliminary outlay; a great deal of manipulation and handling is requisite in using them; they require a large space, are difficult of transportation, and are liable to get easily out of repair. And what is still more important, the metal moulds do not permit the free escape of the gases evolved from the substances under treatment by the heat.

So importmant are these and some other objections to the use of metal moulds that many articles of caoutchouc manufacture which would be made if these objections did not exist, lie undeveloped for the want of some simple, easy, and economical process of forming or shaping, or keeping or holding the shape, of the articles while they are being heated or vulcanized.

By our improved method, we are enabled to manufacture a great variety of articles of caoutchouc or its compounds which could
682 not before be made, and to manufacture other articles with greater facility and economy than before,

Our invention consists in using or employing sand, pulverized soapstone, plaster, or some similar granular or pulverized and, when put together, porous matter or moulds made of porous substances, to sustain and keep the form of moulded or modeled articles composed of caoutchouc or its compounds and other gums susceptible of vulcanization during the process of heating or vulcanization.

We take articles composed of compounds of caoutchouc or other gums susceptible of vulcanization in the green state.

We cause them to be pressed or otherwise formed into the exact shapes which they are required to have after being vulcanized. We

then cover the surface of the articles with pulverized soapstone or plaster or other similar non-adhesive powder. We then place the articles in a box filled with sand, the finer the sand the better, or pulverized soapstone, or other similar equivalent granular or pulverized matter, so that each article shall be completely surrounded and covered by the sand or pulverized soapstone or plaster, etc., and imbedded in the same and thereby sustained.

When it is desired to give a very smooth surface to the article, we cause it to be completely surrounded with a layer of soapstone, even though sand may be employed about the layer of soapstone. We sometimes use moist sand or pulverized soapstone. When the articles are thus properly placed in the box, we subject the sand or other material to pressure so that the box shall be solidly filled; we then, by means of a cover or sometimes by pressure, confine the sand or other material, so that the articles shall be at all times in contact with and pressed upon by the sand or other material during the process of heating. We then place the articles thus surrounded with and sustained by sand or pulverized soapstone or other material in an oven or heater, and subject the same to a high degree of artificial heat, moist or dry heat, say from 260° to 300° Fahrenheit, for a period of from three to seven hours, and upon taking the articles out of the sand or other material, the articles will be found to be vulcanized in the same form in which they were when put into the sand.

We are thus enabled to produce economically a great variety of objects, among them embossed or indented or plain sheets or plates or masses of regular or irregular forms, convex or concave, such as pieces of furniture, book-covers, buttons, toys of various kinds, etc. Or we make the moulds of plaster of Paris, best calcined, or other substance which when dried will be porous and permit the escape of gases evolved from the matter under treatment, and all contained air, and thereby prevent the expansion of confined air and other gases from injuring the surface of the moulded substance. Or we mould the article in a
683 mould which is to produce the figure, and pack in sand or pulverized soapstone or other like granular pulverized substance to support the other surface or surfaces of the article to be produced, and thus keep the face which is to be figured in contact with the partial mould of metal or plaster or other material, and thus afford a free discharge for air and gases, whilst at the same time the moulds are greatly cheapened. The moulds or outer casing may be made of glass instead of iron or other metal. But we prefer the first mode of procedure, as it avoids entirely the use of moulds during the process of vulcanization, the sand or other pulverized or granular material having the effect thoroughly to support and retain the form previously given to the article by moulding or modeling. The prepared caoutchouc (gutta-percha, etc.), if it is to be imbedded in moistened plaster, should be previously varnished; and to keep the surface of such articles to be thus vulcanized in sand, smooth India paper should be interposed between such surface and the sand.

Having thus fully described the nature of our invention, what we claim and desire to secure by letters patent is the art or method of manufacturing articles composed in part of caoutchouc, or other gums susceptible of vulcanization, by heating or vulcanizing the same when surrounded with and pressed upon externally or internally by, or moulded in, pulverized soapstone, sand, plaster, or other similar granular, pul-

verized, or porous matter, or in moulds of plaster or other porous substance, substantially as herein described.

CHARLES GOODYEAR.
ROBERT HAERING.

Witnesses:
JOSEPH H. DORR.
JAMES A. DORR.

684 I, Douglas John Newton, notary public by royal authority, duly admitted and sworn, practising in London, do hereby certify and attest unto all whom it shall or may concern that the seal impressed on the paper, writing, or copy hereunto annexed is the seal of the commissioners of patents for inventions of the city of London; also, that the signatures "Charles Pratt Barlow" and "Robert McLarney," set and subscribed at foot thereof, are the real signatures and proper handwriting respectively of Charles Pratt Barlow and Robert McLarney, clerks in the said office of the commissioners of patents for inventions.

Whereof an act being required, I, the said notary, have granted these presents under my notarial firm and seal of office, to serve and avail as occasion shall or may require.

Done and passed in London this fourth day of September, one thousand eight hundred and seventy-two.

In testimonium veritatis.

[L. S.] DOUGLAS J. NEWTON,
Notary Public.

CONSULATE-GENERAL OF THE UNITED STATES OF AMERICA,
LONDON.

I, Joshua Nunn, vice-consul-general of the United States of America for Great Britain and Ireland, at London, do hereby make known and certify to all whom it may concern, that Douglas John Newton, who hath signed the annexed certificate, is a notary public, duly admitted and sworn, and practising in the city of London aforesaid, and that to all acts by him so done full faith and credit are and ought to be given in judicature and thereout.

In testimony whereof I have hereunto set my hand and affixed the seal of the consulate-general of the United States at London aforesaid this fifth day of September, in the year of our Lord one thousand eight hundred and seventy-two, and in the ninety-seventh year of the Independence of the said United States.

[L. S.] J. NUNN.

577.

14TH MARCH, 1855.—Petition, declaration, and provisional specification of Charles Goodyear, jr., of No. 42 Avenue Gabriel, Champs Elysées in the city of Paris, for grant of letters patent for an invention for "improvements in the plates of artificial teeth."

Sealed with the commissioners' seal and referred to the attorney-general.

685 17TH MARCH.—Petition, declaration, and provisional specification left with attorney-general for allowance.

SAME DAY.—Certificate of leaving and record delivered to agent of petitioner.

27TH MARCH.—Certificate of attorney-general, allowing provisional protection, received and filed, and certificate thereof given.

30TH MARCH.—Notice to proceed received and filed, and certificate thereof given.

SAME DAY.—Provisional protection advertised in Gazette.

3D APRIL.—Notice to proceed advertised in Gazette.

26TH APRIL.—Petition, declaration, and provisional specification again referred to attorney-general.

28TH APRIL.—Fiat for warrant received.

2D MAY.—Warrant left with attorney-general for signature.

4TH MAY.—Warrant received, sealed, and filed.

8TH MAY.—Letters patent prepared, sealed, and dated the 14th March, 1855.

11TH SEPTEMBER.—Specification filed in pursuance of letters patent.

5TH OCTOBER, 1857.—License, Goodyear to Putnam & ano'r. Book Q, page 223.

13TH MARCH, 1858.—Letters patent expired, not having been produced stamped with £50 stamp at the office of commissioners of patents.

We certify this to be a true copy.

CHARLES PRATT BARLOW,
ROBERT McLARNEY,
Clerks in the office of the Commissioners of Patents for Inventions.

686 I, Douglas John Newton, notary public by royal authority, duly admitted and sworn, practising in London, do hereby certify and attest unto all whom it shall or may concern, that the seal impressed on the "office copy letter patent," hereunto annexed, is the seal of the commissioners of patents for inventions of the city of London; also, that the signatures "Edward Towers" and "Charles Lever," set and subscribed at the foot of the said office copy letters patent, are the real signatures and proper handswriting respectively of Edward Towers and of Charles Lever, clerks in the said office of the commissioners of patents for inventions; whereof an act being required, I, the said notary, have granted these presents under my notarial form and seal of office, to serve and avail as occasion shall or may require.

Done and passed in London this fourth day of September, one thousand eight hundred and seventy-two.

In testimonium veritatis.

[L. S.] DOUGLAS J. NEWTON,
Notary Public.

CONSULATE-GENERAL OF THE UNITED STATES OF AMERICA,
LONDON.

I, Joshua Nunn, vice-consul-general of the United States of America for Great Britain and Ireland, at London, do hereby make known and certify to all whom it may concern, that Douglas John Newton, who hath signed the annexed certificate, is a notary public duly admitted and sworn, and practising in the city of London aforesaid; and that to all acts by him so done full faith and credit are and ought to be given in judicature and throughout.

In testimony whereof I have hereunto set my hand and affixed the seal of the consulate-general of the United States, at London aforesaid, this fifth day of September, in the year of our Lord one thousand eight hundred and seventy-two, and in the ninety-seventh year of the Independence of the said United States.

[L. S.] J. NUNN.

1855. No. 577.

Victoria, by the grace of God, of the United Kingdom of Great Britain and Ireland Queen, Defender of the Faith, to all to whom these presents shall come, greeting:

Whereas Charles Goodyear, jr., of No. 42 Avenue Gabriel, Champs Elysées, in the city of Paris, hath, by his petition, humbly
687 represented unto us that he is in possession of an invention for "improvements in the plates of artificial teeth," which the petitioner believes will be of great public utility; that he is the first and true inventor thereof, and that the same is not in use by any other person or persons to the best of his knowledge and belief; the petitioner therefore most humbly prayed that we would be graciously pleased to grant unto him, his executors, administrators, and assigns, our royal letters patent for the sole use, benefit, and advantage of his said invention within our United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, for the term of fourteen years, pursuant to the statute in that case made and provided. And we, being willing to give encouragement to all arts and inventions which may be for the public good, are graciously pleased to condescend to the petitioner's request:

Know ye, therefore, that we, of our especial grace, certain knowledge, and mere motion, have given and granted, and by these presents, for us, our heirs and successors, do give and grant unto the said Charles Goodyear, his executors, administrators, and assigns, our especial license, full power, sole privilege, and authority, that he, the said Charles Goodyear, his executors, administrators, and assigns, and every of them by himself and themselves, or by his and their deputy or deputies, servants or agents, or such others as he the said Charles Goodyear, his executors, administrators, or assigns, shall at any time agree with, and no others, from time to time and at all times hereafter during the term of years herein expressed, shall and lawfully may make, use, exercise, and vend his said invention within our United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, in such manner as to him the said Charles Goodyear, his executors, administrators, and assigns, or any of them, shall in his or their discretion seem meet; and that he the said Charles Goodyear, his executors, administrators, and assigns, shall and lawfully may have and enjoy the whole profit, benefit, commodity, and advantage from time to time coming, growing, accruing, and arising by reason of the said invention, for and during the term of years herein mentioned, to have, hold, exercise, and enjoy the said licenses, powers, privileges, and advantages hereinbefore granted, or mentioned to be granted, unto the said Charles Goodyear, his executors, administrators, and assigns, for and during and unto the full end and term of fourteen years from the day of the date of these presents next and immediately ensuing, according to the statute in such case made and provided; and to the end that he the said Charles Goodyear, his executors, administrators, and assigns, and every of them, may have and enjoy the full benefit and the sole use and exercise of the said invention, according to our gracious intention hereinbefore declared, we do, by these presents, for us, our heirs, and successors, require and
688 strictly command all and every person and persons, bodies politic and corporate, and all other our subjects whatsoever, of what estate, quality, degree, name, or condition soever they be, within our United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, that neither they nor any of them, at any time during

the continuance of the said term of fourteen years, hereby granted, either directly or indirectly, do make, use, or put in practice the said invention or any part of the same so attained unto by the said Charles Goodyear, as aforesaid, nor in anywise counterfeit, imitate, or resemble the same; nor shall make or cause to be made any addition thereunto or subtraction from the same whereby to pretend himself or themselves the inventor or inventors, devisor or devisors thereof, without the consent, license, or agreement of the said Charles Goodyear, his executors, administrators, or assigns, in writing under his or their hands and seals first had and obtained in that behalf, upon such pains and penalties as can or may be justly inflicted on such offenders for their contempt of this our royal command; and further, to be answerable to the said Charles Goodyear, his executors, administrators, and assigns, according to law, for his and their damages thereby occasioned. And moreover, we do by these presents, for us, our heirs, and successors, will and command all and singular the justices of the peace, mayors, sheriffs, bailiffs, constables, headboroughs, and all other officers and ministers whatsoever of us, our heirs, and successors for the time being, that they or any of them do not nor shall at any time during the said term hereby granted, in anywise molest, trouble, or hinder the said Charles Goodyear, his executors, administrators, or assigns, or any of them, or his or their deputies, servants, or agents, in or about the due and lawful use or exercise of the aforesaid invention or anything relating thereto; provided always, and these, our letters patent, are and shall be upon this condition, that if at any time during the said term hereby granted it shall be made appear to us, our heirs, or successors, or any six or more of our or their privy council, that this our grant is contrary to law or prejudicial or inconvenient to our subjects in general, or that the said invention is not a new invention as to the public use and exercise thereof within our United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, or that the said Charles Goodyear is not the first and true inventor thereof within this realm, as aforesaid, these, our letters patent, shall forthwith cease, determine, and be utterly void, to all intents and purposes, anything hereinbefore contained to the contary thereof in anywise notwithstanding: Provided also, That these, our letters patent, or anything herein contained, shall not extend or be construed to extend to give privilege unto the said Charles Goodyear, his executors, administrators, or assigns, or any of them, to use or imitate any invention or work whatsoever which hath heretofore
689 been found out or invented by any other of our subjects whatsoever, and publicly used or exercised within our United Kingdom of Great Britain and Ireland, the Channel Islands, or Isle of Man, unto whom our like letters patent or privileges have been already granted for the sole use, exercise, and benefit thereof. It being our will and pleasure that the said Charles Goodyear, his executors, administrators, and assigns, and all and every other person and persons to whom like letters patent or privileges have been already granted, as aforesaid, shall distinctly use and practice their several inventions by them invented and found out, according to the true intent and meaning of the same respective letters patent and of these presents: Provided likewise, nevertheless, and these, our letters patent, are upon this express condition, that if the said Charles Goodyear shall not particularly describe and ascertain the nature of the said invention, and in what manner the same is to be performed by an instrument in writing under his hand and seal, and cause the same to be filed in the great seal patent office within six calendar months next and immediately after the date

of these, our letters patent; and also if the said Charles Goodyear, his executors, administrators, or assigns, shall not pay the stamp duty of fifty pounds and produce these, our letters patent, stamped with a proper stamp to that amount, at the office of our commissioners of patents for inventions before the expiration of three years from the date of these, our letters patent, pursuant to the provisions of the act of the sixteenth year of our reign, chapter 5; and also, if the said Charles Goodyear, his executors, administrators, or assigns, shall not pay the stamp duty of one hundred pounds and produce these, our letters patent, stamped with a proper stamp to that amount at the said office of our said commissioners before the expiration of seven years from the date of these our letters patent, pursuant also to the said act; and also, if the said Charles Goodyear, his executors, administrators, or assigns, shall not supply or cause to be supplied for our service all such articles of the said invention as he or they shall be required to supply by the officers or commissioners administering the department of our service, for the use of which the same shall be required in such manner, at such times, and at and upon such reasonable prices and terms as shall be settled for that purpose by the said officers or commissioners requiring the same; that then and in any of the said cases these, our letters patent, and all liberties and advantages whatsoever hereby granted, shall utterly cease, determine, and become void, anything hereinbefore contained to the contrary thereof in anywise notwithstanding; provided, that nothing herein contained shall prevent the granting of licenses in such manner and for such considerations as they may by law be granted. And lastly, we do, by these presents, for us, our heirs, and successors, grant unto the said Charles
690 Goodyear, his executors, administrators, and assigns, that these, our letters patent, or the filing thereof, shall be in and by all things good, firm, valid, sufficient, and effectual in the law, according to the true intent and meaning thereof, and shall be taken, construed, and adjudged in the most favorable and beneficial sense for the best advantage of the said Charles Goodyear, his executors, administrators, and assigns, as well in all our courts of record as elsewhere, and by all and singular the officers and ministers whatsoever of us, our heirs, and successors in our United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, and among all and every the subjects of us, our heirs, and successors whatsoever and wheresoever, notwithstanding the not full and certain describing the nature or quality of the said invention, or of the materials thereunto conducing and belonging.

In witness whereof we have caused these, our letters, to be made patent this fourteenth day of March, one thousand eight hundred and fifty-five, in the eighteenth year of our reign, and to be sealed as of the said fourteenth day of March, one thousand eight hundred and fifty-five.

By warrant.

We hereby certify the above to be a true copy.

EDWARD TOWERS,
CHARLES LEVER,
Clerks in the Office of the Commissioners of Patents for Inventions.

691 I, Douglas John Newton, notary public by royal authority, duly admitted and sworn, practising in London, do hereby certify and attest unto all whom it shall or may concern, that the seal impressed on

the printed matter or copy of specification hereunto annexed is the seal of the commissioners of patents for inventions of the city of London. Also that the signatures "Jeken J. V. Elwin" and "Henry Archer Cheeswright," set and subscribed at foot thereof, are the real signatures and proper handwriting respectively of Jeken James Vincent Elwin and Henry Archer Cheeswright, clerks in the said office of the commissioners of patents for inventions.

Whereof, an act being required, I, the said notary, have granted these presents under my notarial firm and seal of office, to serve and avail as occasion shall or may require.

Done and passed in London this fourth day of September, one thousand eight hundred and seventy-two.

In testimonium veritatis.

[L. S.] DOUGLAS J. NEWTON,
Notary Public.

CONSULATE-GENERAL OF THE UNITED STATES OF AMERICA, LONDON.

I, Joshua Nunn, vice consul-general of the United States of America for Great Britain and Ireland at London, do hereby make known and certify to all whom it may concern that Douglas John Newton, who hath signed the annexed certificate, is a notary public, duly admitted and sworn, and practising in the city of London aforesaid, and that to all acts by him so done full faith and credit are and ought to be given in judicature and thereout.

In testimony whereof I have hereunto set my hand and affixed the seal of the consulate-general of the United States, at London aforesaid, this fifth day of September, in the year of our Lord one thousand eight hundred and seventy-two, and in the ninety-seventh year of the Independence of the said United States.

[L. S.] J. NUNN.

692 A. D. 1855. No. 577.

Specification of Chas. Goodyear, jr. Plates for artificial teeth. Letters patent to Charles Goodyear, jr., of No. 42 Avenue Gabriel, Champs Elysées, in the city of Paris, for the invention of "improvements in the plates of artificial teeth." Sealed the 8th May, 1855, and dated the 14th March, 1855.

Provisional specification left by the said Charles Goodyear, jr., at the office of the commissioners of patents, with his petition, on the 14th March, 1855.

I, Charles Goodyear, jr., of No. 42 Avenue Gabriel, Champs Elysées, in the city of Paris, do hereby declare the nature of the invention for "improvements in the plates of artificial teeth" to be as follows:

This invention consists of constructing the plates of artificial teeth of the hard product obtained by compounding India rubber or gutta-percha (with or without other matters) with sulphur, and subjecting the same to a high temperature. For this purpose I take an impression from the mouth of the patient (in the manner usually practiced by dentists) with wax or suitable plastic material, from which impression I take a cast in plaster of Paris. Upon this model I carefully adjust teeth of the form and size required, and in the position which I wish them afterwards to occupy in the mouth of the patient, using wax or other plastic

substance to retain them in the proper position. I then spread a thin coat or layer of wax over portions of the model, of the form and thickness required, which layer of wax represents a model of the plate of caoutchouc which is afterwards to support the teeth and keep them firm in the mouth. When the crevices or cavities in or between the teeth are filled up with the wax, and the model of the plate completed, I take a plaster cast from the same, which cast I prefer should be inclosed in an iron rim or box for the purpose of strength. This, when completed, together with the original plaster model (which I also prefer should be in an iron rim), form a mould which I use in the following manner:

After removing the wax from the cavities and crevices in or between the teeth, I readjust the teeth in their proper positions in the mould.

693 I then fill up the cavities and crevices and other vacant space in the mould with caoutchouc or gutta-percha suitably prepared with sulphur, and after putting the several parts of the mould together and subjecting them to a sufficient degree of pressure, I cause the whole, that is to say, the mould containing the teeth with the caoutchouc or gutta-percha, to be subjected to heat to convert the compound into the hard product. To obtain a suitable color I mix with the caoutcuouc or gutta-percha vermillion, oxides of zinc or iron, or any coloring substance which will stand the necessary degree of heat with the action of the sulphur. The best compound I believe to be one pound of India rubber or gutta-percha, or of the two combined in suitable proportions, with half a pound of sulphur, together with a suitable quantity of coloring matter.

I sometimes find it convenient to substitute the material for the masticators or teeth hidden from view, for which purpose the material is well fitted from its extreme hardness and durability. In order that the teeth may be more firmly attached to the plate, I prefer that they should be jagged or rough, or have small cavities in the roots or parts imbedded in the plates.

Specification in pursuance of the conditions of the letters patent filed by the said Charles Goodyear, jr., in the great seal patent office on the 11th September, 1855.

To all to whom these presents shall come, I, Charles Goodyear, jr., of No. 42 Avenue Gabriel, Champs Elysées, in the city of Paris, send greeting.

Whereas her most Excellent Majesty Queen Victoria, by her letters patent, bearing date the fourteenth day of March, in the year of our Lord one thousand eight hundred and fifty-five, in the eighteenth year of her reign, did, for herself, her heirs and successors, give and grant unto me, the said Charles Goodyear, her special license that I, the said Charles Goodyear, my executors, administrators, and assigns, or such others as I, the said Charles Goodyear, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an invention for "improvements in the plates of artificial teeth," upon the condition (amongst others) that I, the said Charles Goodyear, by an instrument in writing under my hand and seal, should particularly describe and ascertain the nature of the said invention, and in what manner the same was to be performed, and cause the

694 same to be filed in the great seal patent office within six calendar months next and immediately after the date of the said letters patent:

Now know ye that I, the said Charles Goodyear, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof (that is to say):

This invention consists of constructing the plates of artificial teeth of the hard product obtained by compounding India rubber or gutta-percha (with or without other matters) with sulphur, and subjecting the same to a high temperature. For this purpose I take an impression from the mouth of the patient (in the manner usually practised by dentists) with wax or suitable plastic material, from which impression I take a cast in plaster of Paris. Upon this model I carefully adjust teeth of the form and size required, and in the position which I wish them afterwards to occupy in the mouth of the patient, using wax or other plastic substance to retain them in the proper position. I then spread a thin coat or layer of wax over portions of the model, of the form and thickness required, which layer of wax represents a model of the plate of caoutchouc which is afterwards to support the teeth and keep them firm in the mouth. When the crevices or cavities in or between the teeth are filled up with the wax, and the model of the plate completed I take a plaster cast from the same, which cast I prefer should be inclosed in an iron rim or box for the purpose of strength. This, when completed, together with the original plaster model (which I also prefer should be in an iron rim), form a mould which I use in the following manner:

After removing the wax from the cavities and crevices in or between the teeth, I readjust the teeth in their proper positions in the mould. I then fill up the cavities and crevices and other vacant space in the mould with caoutchouc or gutta-percha suitably prepared with sulphur, and after putting the several parts of the mould together, and subjecting them to a sufficient degree of pressure, I cause the whole, that is to say, the mould containing the teeth with the caoutchouc or gutta-percha, to be subjected to heat, to convert the compound into the hard product. To obtain a suitable color, I mix with the caoutchouc or gutta-percha vermillion, oxides of zinc or iron, or any coloring substance which will stand the necessary degree of heat with the action of the sulphur. The best compound I believe to be one pound of India rubber or gutta-percha, or of the two combined in suitable proportions, with half a pound of sulphur, together with a suitable quantity of coloring matter.

I sometimes find it convenient to substitute the material for the masticators or teeth hidden from view, for which purpose the material is well fitted from its extreme hardness and durability. In order
695 that the teeth may be more firmly attached to the plate, I prefer that they should be jagged or rough, or have small cavities in the roots or parts imbedded in the plates.

Having thus described the nature of the said invention, I have only further to state, that in thus making improvements in artificial plates and teeth of India rubber and gutta-percha compounds, combined with sulphur, that whilst in the moulds I cause the materials and the moulds to be subjected to heat for about six hours, and in doing so I gradually raise the heat up to about 230° of Fahrenheit, say, in about half an hour, and then, unless there be a considerable quantity of foreign matter present, the heat may be raised as quickly as may be to about 295° of

Fahrenheit; otherwise I raise the heat more slowly, and retain the compound at about that temperature for the remainder of the six hours, and then allow the whole to cool down, when the process will be completed. The artificial plates or teeth thus formed will then be ready to be trimmed and fitted.

I claim the above-described manufacture of artificial plates and teeth.

In witness whereof I, the said Charles Goodyear, have hereunto set my hand and seal, this eighth day of September, in the year of our Lord one thousand eight hundred and fifty-five.

CHAS. GOODYEAR, JR. [L. S.]

Witness:

FANNY GOODYEAR.

We hereby certify the above to be a true copy.

JEKEN J. V. ELWIN,
HENRY ARCHER CHEESWRIGHT,
Clerks in the Patent Office.

696 The United States Patent Office, to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office, of the letters patent granted to Sharpless Clayton, dated January 2d, 1855, No. 12156, for "improvement in teeth."

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this sixteenth day of October, in the year of our Lord one thousand eight hundred and seventy-two, and of the Independence of the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

No. 12156.

The United States of America, to all to whom these letters patent shall come:

Whereas Sharpless Clayton, of West Chester, Pennsylvania, has alleged that he has invented a new and useful improvement in teeth, which he states has not been known or used before his application; has made affirmation that he is a citizen of the United States; that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are therefore to grant, according to law, to the said Sharpless Clayton, his heirs, administrators, or assigns, for the term of fourteen years from the second day of January, one thousand eight hundred and fifty-five, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improve-
697 ment, a description whereof is given in the words of the said Clayton, in the schedule hereunto annexed, and is made a part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand at the city of Washington, this second day of January, in the year of our Lord one thousand eight hundred and fifty-five, and of the Independence of the United States of America the seventy-ninth.

ROBERT McCLELLAND,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[L. S.]
C. MASON,
Commissioner of Patents.

The schedule referred to in these letters patent, and making part of the same.

To all whom it may concern:

Be it known that I, Sharpless Clayton, of West Chester, in the county of Chester and State of Pennsylvania, have invented a new and improved method of securing porcelain teeth to metallic plates, and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the annexed drawings, making a part of this specification, in which—

Fig. 1 is a plain view inverted with the plate removed.

Fig. 2 is a sectional view.

Fig. 3 is a section through the line *x*, *x*, Fig. 2.

Like letters refer to like parts in the different views.

The nature of my improvement consists in an improved method of securing porcelain teeth to metallic plate.

To enable others skilled in the arts to make and use my invention, I will proceed to describe the process of making and using it.

The teeth are mounted on a plate prepared in the usual way, by means of wax to fill up all crevices, then they are inverted and a second cast of plaster is made to form the two moulds; then the two casts are separated, and the plate and wax removed. Then three gates are made through the lower mould at the base of the teeth, through which the metal is poured, said metal consisting of chemically pure tin. When the metal is cool the moulds may be separated and the plate and teeth removed and finished in the ordinary way.

698 The teeth and gums are formed of solid porcelain, and are provided with a dovetail groove A, which extends around the base of the teeth as seen in Fig. 1, into which the dovetail flange B takes, as seen in Fig. 2. I also form holes, seen in Fig 1, in the teeth, which are filled with pins, as seen in Figs. 1, 2, said flange and pins being cast into the groove A by the above-described process.

The teeth may be attached to silver, gold, or metallic plates of any kind by casting the flange B of tin, and at the same time uniting it with the plate.

Having thus described my process of securing porcelain teeth to metallic plates,

What I claim as my invention, and desire to secure by letters patent, is the dovetail grooves formed in the base of the teeth, and the holes through the teeth, said groove and holes to be filled with pure tin, cadmium, or any other fusible metal, so as to form a dovetail flange and pins as described, for the purpose of securing the teeth and gums to metallic plates, as herein set forth and described.

In testimony whereof I, the said Sharpless Clayton, hereto subscribe

my name, in the presence of the witnesses whose names are hereto subscribed, on the 25th day of May, A. D. 1854.

SHARPLESS CLAYTON.

Witnesses:
R. EMMET MONAGHAN.
HENRY FLEMING.

699 The United States Patent-Office to all persons to whom these these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the letters patent granted Alfred A. Blandy, dated March 3d, 1857, No. 16708, for "Improvement in casting plates for artificial teeth."

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed this ninth day of October, in the year of our Lord one thousand eight hundred and seventy-two, and of the Independence of the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

No. 16708.

The United States of America to all to whom these letters patent shall come:

Whereas Alfred A. Blandy, of Baltimore, Maryland, has alleged that he has invented a new and useful improvement in casting plates for artificial teeth, which he states has not been known or used before his application; has made oath that he is a citizen of the United States, that he does verily believe that he is the original and first inventor or discoverer of said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose.

These are therefore to grant, according to law, to the said Alfred A. Blandy, his heirs, administrators, or assigns, for the term of fourteen years from the third day of March, one thousand eight hundred and fifty-seven, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said im-
700 provement, a description whereof is given in the words of the said Blandy in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Patent-Office has been hereunto affixed.

Given under my hand at the city of Washington, this third day of March, in the year of our Lord one thousand eight hundred and fifty-seven, and of the Independence of the United States of America the eighty-first.

ROBERT McCLELLAND,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent-Office.

[L. S.]

C. MASON,
Commissioner of Patents.

The schedule referred to in these letters patent, and making part of the same.

To all to whom these presents shall come:

Be it known that I, Alfred A. Blandy, of the city and county of Baltimore, in the State of Maryland, have invented a new and useful improvement in the process of moulding the plates of artificial teeth, of which the following is a full and accurate description, reference being had to the accompanying drawings, in which—

Figs. 1 and 2 represent side elevations of a jointed plastic cast technically termed the "articulator," the front half of which may be taken to represent the upper and lower jaw during my process, preparatory to the adjustment of the teeth thereon. In Fig. 1, the wax rim is represented as being too long in front, and in Fig. 2 as properly trimmed.

Fig. 3 represents a vertical longitudinal section of Fig. 2; and

Fig. 4 a similar view of the upper plate (and upper half of the articulator), after the teeth have been adjusted and the wax reduced to the proper shape and thickness preparatory to moulding.

Fig. 5 represents a vertical longitudinal section (through a central incisor tooth) of the moulding flask, with the teeth and pattern plate enclosed; and

Fig. 6 a similar view of the same, with pattern plate removed and prepared for pouring the metal.

The object of my invention is to obtain an accurate fit of the
701 dental plate to the gums, and a correct articulation of the teeth upon casting, by which the tedious and laborious processes heretofore used for this purpose are dispensed with.

To enable others skilled in the art to make and use my invention, I will now proceed to describe it in detail.

An impression of the mouth being obtained as in other processes, a "cast" is taken therefrom, which subsequently forms one-half (A, Figs. 5 and 6) of the moulding flask. Upon this cast a pattern plate *a*, *b*, made of rolled wax $\frac{1}{30}$th to $\frac{1}{50}$th of an inch thick, and lined on the side next the cast with metallic foil $\frac{1}{200}$th to $\frac{1}{300}$th of an inch thick, is carefully pressed and trimmed to the required shape, and a rim (*c*) of wax about $\frac{1}{4}$th of an inch wide placed upon the alveolar ridge of the same. The process is repeated for the lower jaw in cases of entire loss of teeth; both plates, with their wax rims, are then introduced in the mouth (Fig. 1), and the wax trimmed until the two rims touch at all points (Fig. 2), due attention being had to the correct closure and proper spacing of the jaws—points essential to the natural appearance of the artificial teeth, as also to their comfort and utility. The two plates, while thus in the mouth, are so marked upon their wax rims, that when withdrawn they may be replaced in precisely the same relation; the double cast technically termed the "articulator" (Fig. 2) is then formed upon them, preparatory to the adjustment and arrangement of the teeth upon the rim of wax (*c*), which adjustment will require the removal more or less completely of said wax rims; the plates being held meanwhile securely in proper position by the "articulator."

By this process the plate adapts itself with unerring accuracy to the teeth, whereby I am saved the great expenditure of time and patience necessary in the articulation of teeth by other methods where each tooth requires to be ground to fit the plate.

The teeth having been arranged, they are, for greater security, again tried in the mouth, and any slight changes necessary made. After which all superfluous wax is removed, leaving only so much as is de-

twelfth year of her reign, did, for herself, her heirs, and successors, give and grant unto me, the said Edwin Thomas Truman, my executors, administrators and assigns, her especial license, full power, sole privilege and authority, that I, the said Edwin Thomas Truman, my executors, administrators, and assigns, or such others as I, the said Edwin Thomas Truman, my executors, administrators, or assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales, and the town of Berwick upon Tweed, my invention of "an improved method or methods of constructing and fixing artificial teeth and gums, and of supplying deficiencies in the mouth;" in which said letters patent is contained a proviso that I, the said Edwin Thomas Truman, should cause a particular description of the nature of my said invention, and in what manner the same is to be performed, to be enrolled in her said Majesty s high court of chancery within six calendar months next and immediately after the date of the said in part recited letters patent, as in and by the same, reference being thereunto had, will more fully and at large appear;

Now know ye, that in compliance with the said proviso, I, the said Edwin Thomas Truman, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following statement thereof, that is to say:

704 My invention consists, first, of employing gutta-percha in the manufacture of artificial teeth and gums, and in making good other defects in the mouth in connection therewith.

And, secondly, my invention consists of improvements in the manufacture of artificial teeth and gums by employing the process of electrotype in coating soft substances.

And in order that my invention may be most fully understood and readily carried into effect, I will proceed to explain the means pursued by me.

It is usual in making artificial teeth to obtain a cast, by means of wax, of the mouth in its imperfect state, showing the parts to be made up by artificial teeth and gums, and from such cast a plaster model is obtained, and if there be any defect in the mouth, near the gums, then such model represents such defects, as well as the loss of teeth. The means of obtaining such plaster model being well understood, it will not be necessary for me to enter into a description thereof.

Having got a model of the mouth in plaster, hardened in the usual manner with resin, etc., I proceed to construct a metal frame, by preference of gold, either of wire or otherwise, the purport of which is to give support to the pins for the artificial teeth, and to strengthen the piece where it would otherwise be weak, if it be a case that requires such strengthening, as in lower jaw cases, where the plate or bar has hitherto passed behind the remaining teeth; and as this frame is not in the finished case, either to touch the gum or remaining teeth, but to be enclosed in the gutta-percha, it is not necessary that it should fit the model, but merely that it should be constructed to effect the purposes above named. The teeth being prepared of the proper length and color, I solder pins to receive them in the above-mentioned frame in their proper places, in the same manner I should if placing them on a gold plate of the usual make; but it is not necessary to fit them to the frame, as the gutta-percha form sockets around and under them, which

receive them in like manner as teeth are naturally articulated in the jaw.

I then proceed to mould or form the gutta-percha, which I prefer to have as pure as I can purchase it; gutta-percha, when heated, being, as is well known, very plastic and readily pressed into any form. First, I entirely enclose the metal frame, as above described, in gutta-percha, except the pins; this is readily done with the fingers. Then I place it on the plaster model, previously wet with cold water, in such a manner as to bring the teeth, when placed on their respective pins, into their proper place, to supply the deficiency. I then proceed to mould the gutta-percha into the proper form, to replace all the lost structures, without altering the surface that touches the model; this I effect either by again making it hot in water, or by the aid of heated instru-
705 ments, or by both, as the case may require, but for this part of my invention I can give no precise rule, as it must depend on the case; and the gutta-percha must, at the same time, if necessary, be carried over other parts of the mouth not hitherto deficient, as has been the custom with gold plate on other substances, either to equalize pressure or gain support.

By this means the gutta-percha will, with the new teeth, fit those parts of the mouth where wanting; and in order to make up for any imperfections in the plaster model, I warm the gutta-percha of the artificial teeth constructed as above explained, and place the same into the mouth and press it into position, by which it will become perfectly adapted to the mouth. I then remove the same from the mouth and take the teeth off the pins, by which the sockets in the gutta-percha will be left empty. I then coat over the pins with wax or other matter, which will prevent deposit of gold in the process of electro-gilding, which I now cause to be performed within the sockets, also on outer and inner surfaces of the gutta-percha, leaving the surface thereof which comes next the gums so that a surface of gutta-percha will come next the gums. And such is the peculiar property of this matter, that it may be made most accurately to fit the gums, cavities and imperfections of the mouth near the gums; and artificial teeth thus made will not require any other mode of fixing when in the mouth than what results from a good fit. I do not, however, say that in no case other fastenings may not be required, but in all cases which have come before me I have not found other fastenings necessary. The electro-gilding will line the sockets for the teeth, and also the external surfaces, such electro-gilding being performed, as is well understood, by preparing the surfaces to be gilt in the ordinary manner. The teeth are then to be fixed on to the pins and into the sockets by cement, as heretofore when using gold plates; and any of the various descriptions of teeth may be employed, to which, separately, I make no claim. It is not essential to making artificial teeth and gums, according to my invention, that the gutta-percha used should be coated with gold. And I would state that, although I prefer to employ gutta percha alone, I do not confine myself thereto, as coloring or other matter may be used therewith.

In carrying out the second part of my invention, in place of using gutta-percha and electro-gilding as above explained, I employ hard wax or other matter which may be readily moulded or shaped in the forms described in respect to gutta-percha, and then by electro-gilding the same all over I can obtain artificial teeth fitting with great accuracy; and according to this plan the moulded or shaped matter may be such as would be unsuited to be worn in the mouth if it were not for the coating with gold, which will not only give strength, but also pre-

706 vent any moisture getting to the interior matter which constitutes the setting of the teeth.

Having thus described the nature of my invention, and the manner in which the same is to be performed, I would state in respect to the first part of my invention, that I am aware that gutta-percha has been before employed for temporarily filling up a space in the mouth caused by removing a tooth or teeth, and the same has been allowed to remain till artificial teeth for fitting such spaces have been prepared; and further, I have been informed that gutta-percha has been used for making good some defects in the mouth, but not in connection with artificial teeth and gums, and I mention these particulars in order to state that I make no claim to such use of gutta-percha. But what I claim is:

First, the manufacturing of artificial teeth and gums, and making good other deficiencies of the mouth in connection therewith, by employing gutta-percha; and I also claim the coating the surfaces thereof with metal.

And, secondly, I claim the application of electro-gilding in the manufacture of artificial teeth and gums, as a coating to soft materials, as herein explained.

In witness whereof, I, the said Edwin Thomas Truman, have hereunto set my hand and seal, this fifteenth day of February, one thousand eight hunded and forty-nine.

EDWIN THOS. TRUMAN. [L. S.]

And be it remembered that on the fifteenth day of February, in the year of our Lord 1849, the aforesaid Edwin Thomas Truman came before our said lady the Queen, in her chancery, and acknowledged the specification aforesaid, and all and everything therein contained and specified, in form above written. And also the specification aforesaid was stamped according to the tenor of the statute made for that purpose.

Enrolled the fifteenth day of February, in the year of our Lord one thousand eight hundred and forty-nine.

We hereby certify the above to be a true copy.

J. STUART S. SCOTT,
SAMUEL CASSERLEY,
Clerks in the Patent Office.

707 A. D. 1855. No. 893.

Artificial teeth, gums, and palates. Letters-patent to Henri Schoofs, of Saint Gilles, near Brussels, in the Kingdom of Belgium, for the invention of "improvements in making, fixing, or attaching artificial teeth, gums, and palates." Sealed the 13th July, 1855, and dated the 21st April, 1855.

Complete specification filed by the said Henri Schoofs at the Office of the Commissioner of Patents, with his petition and declaration, on the 21st April, 1855, pursuant to the 9th section of the patent law amendment act, 1852.

To all to whom these presents shall come:

I, Henri Schoofs, of Saint Gilles, near Brussels, in the Kingdom of Belgium, send greeting:

Whereas I am in possession of an invention for "improvements in

making, fixing, or attaching artificial teeth, gums, and palates," and have petitioned her majesty to grant unto me, my executors, administrators, and assigns, her royal letters-patent for the same, and have made solemn declaration that I verily believe myself to be the true and first inventor thereof:

Now know ye that I, the said Henri Schoofs, do hereby declare that the following complete specification, under my hand and seal, fully describes and ascertains the nature of my said invention and the manner in which the same is to be performed; that is to say—

The object of my improvements is principally the prevention of contact (so hurtful in result) between metal or other hard and unyielding bodies and the natural organs of the mouth. My improvements may be termed homogenic, by reason of the similarity of the texture or nature of the matters employed and the mucous membranes of the mouth, and hygienous from the salutary effects consequent on their use. The difference which exists between every case of dental deterioration (and such cases being innumerable,) it is impossible, and in fact needless if
708 possible, to file special drawings of certain cases; and I believe the description which follows will be found sufficient for all practical dentists—enabling them to work out my invention without difficulty or uncertainty. I proceed as follows: I take the mould of the maxillary roof or palate with soft wax and let plaster flow thereon, which will give an exact reproduction of the organ of which impression shall have been taken, and serves as a model for casting a third reproduction in iron, copper, zinc, or other metal. This process is known to all dentists. On the plaster mould the artificial teeth are adjusted, which are intended to replace the natural ones which shall have been destroyed wholly or in part. These artificial teeth may be either mineral or natural. They are maintained in their places below by the help of plugs or stoppers of wax, and above or exteriorly by liquid plaster, with which all the exposed edges are surrounded. The plaster, in drying, holds firmly the teeth in their places and allows the wax, now become useless, to be taken away. The teeth being now in the position they are definitely to retain, their fastenings are completed either by using platina tenons, screw pivots, or gold plate or gold wire. This incomplete preparation may be offered in the mouth to ascertain the exactitude, and to allow of defects, if any, being remedied, such as bringing forward, putting back, heightening or lowering one or more of the teeth, which is easily effected by the aid of pincers, the metallic ligaments being very ductile. All the foregoing manipulations or operations are well known to dentists, and from this point I commence the specification of my improvements. The preparation just described being adjusted, I take the metal mould and heat it sufficiently. I apply on all the corresponding parts near the impaired maxillary roof or palate a layer of gutta-percha or caoutchouc, either mixed together or seperate, or modified by the mixture of other gums (used plain or colored) according to the greater or less susceptibility of the impaired organs. This layer lies in a ductile or partially-melted state by reason of the heat imparted thereto by the metallic mould. On this layer and at their respective places, the adjusted (as before described) teeth are placed, and all the fixings of wire or plates are covered by another layer. The second layer amalgamating with the first now forms with the teeth a single solid piece. The last layer, as it advances on to the palate or roof of the jaw, diminishes little by little till it is reduced to nothing, so that the tongue may not encounter any ridge or uneavenness that may possibly be avoided. The "modus operandi" is the same for both jaws. When a complete

set of teeth is made, and the upper is connected to the lower piece by the springs generally used, which are very hurtful, as the mucous membranes are frequently caught in the spiral springs and the mucous fills the interior thereof, I cover these springs with a light layer of gutta-percha or caoutchouc, so as to close up all the interstices of the
709 rings or spirals, and so exclude from their cavities all matter whatsoever, without diminishing their elasticity. To obtain greater durability, I cover those parts replacing the natural gums, palate, or roof of the mouth, that is to say, the internal part of the piece or pieces, with a pellicle of gold, by the assistance of the plastic galvanic pile. This pellicle will not in any degree interfere with or lessen the softness or elasticity of the vegetable matter; or the surface above indicated may be covered with very thin gold leaf. This preparation, having for base a substance the texture or nature of which is similar to that of the organs it covers, so closely adheres, or rather is in such immediate juxtaposition thereto, that liquids or food, or particles thereof, rarely find their way between its roof and those portions of the mouth on or over which it is applied. It also prevents the admission of air to the nerves of carious teeth, retarding the progress of that disease, and guaranteeing persons troubled with decayed teeth from the pains hitherto attendant thereon; and the absence of all portions of food or other matters has the like tendency as regards the putrid and unhealthy exhalations arising from the latter named causes in the mouth when teeth, gums, or palates are placed therein according to the systems hitherto in use; and having for base, metals and animal substances which, being hard and inflexible, favor the progress of carious disease, injures the mucous, set on edge the teeth, and occasion hitherto sound teeth to become carious.

Artificial apparatus made according to my invention allow the most delicate membranes (muqueuses) to support without pain or abrasions the strongest efforts of mastication, and the phlegmasy under which the membranes were suffering previously to the application of such apparatus soon disappears. To place the "piece" or apparatus in the mouth, that part which is to adapt itself to the maxillary palate or roof is warmed, and being softened by the heat it is adjusted in its proper place. The wearer should firmly close his or her teeth during a few, say three or four, minutes; and the vegetable matter cooling, envelopes or fits so exactly the least natural ruggedness or irregularity, that the "piece" becomes, as it were, rivetted in its position. Notwithstanding this, such is its elasticity that it may be removed with little effort.

Having now described the nature of my invention and the means by which I carry it into effect, I wish it to be clearly understood that I lay no claim to the exclusive use of any of the articles or substances herein named, when taken as articles or substances separately and not in combination in the manner or for the purposes hereinbefore described; but I do claim as of my invention the exclusive use of the "improvements in making, fixing, or attaching artificial teeth, gums, and palates," having for their base gutta-percha or caoutchouc, employed separately or mixed together, or modified with other gums
710 when so employed, in the manner and for the purposes hereinbefore described.

In witness whereof I, the said Henri Schoofs, have hereunto affixed

my hand and seal this eighteenth day of April, in the year of our Lord one thousand eight hundred and fifty-five.

HENRI SCHOOFS. [L. S.]

Witness:
H. BIEBUYCK,
Rue de Commerce, Brussels.

We hereby certify the above to be a true copy.
SAMUEL CASSERLEY,
H. A. CHEESWRIGHT,
Clerks in the Patent Office.

711 A. D. 1859, 21st January. No. 193.

Manufacture of artificial teeth, gums, etc. Letters patent to James Childs, of Windsor House, Windsor Road, Putney, in the county of Surrey, for the invention of "an improvement in applying heat in the manufacture of artificial gums and teeth, and other articles composed of India rubber or gutta-percha combined with sulphur." Sealed the 28th June, 1859, and dated the 21st January, 1859.

Provisional specification left by the said James Childs at the office of the Commissioners of Patents, with his petition, on the 21st January, 1859.

I, James Childs, of Windsor House, Windsor Road, Putney, in the county of Surrey, do hereby declare the nature of the invention for "an improvement in applying heat in the manufacture of artificial gums and teeth, and other articles composed of India rubber or gutta-percha combined with sulphur," to be as follows:

This invention has for its object an improvement in applying heat in the manufacture of artificial gums and teeth and other articles composed of India rubber or gutta-percha combined with sulphur. When making artificial gums and teeth of a composition of India rubber or gutta-percha and sulphur, the moulded gums or teeth, or a combination of gums and teeth, are secured between plaster of Paris casts or moulds of the mouth they are intended to fit, and in this state they are placed in a suitable vessel capable of being externally heated, and this I prefer to do by gas jets, though heat may be otherwise applied. The vessel (which is provided with a man-hole) is in connection with a steam boiler, so that it can be kept full of steam of low pressure, and such steam when in the vessel is then further heated up to the high degree of heat requisite for producing the well-known hardening effect consequent on high temperatures being applied to India rubber and gutta-percha when combined with sulphur. In like manner, other articles of India rubber or gutta-percha combined with sulphur may, when held in suitable moulds or forms, be introduced into a vessel, which is then filled with steam and heated externally. In place of, or in addition to the steam
712 being heated in the vessel in which the articles are placed, it may, after it leaves the boiler, be heated in its way to and before getting into the vessel. By thus employing steam of low pressure, and obtaining the requisite high temperature by surcharging the steam with heat, the process of "converting" India rubber and gutta-percha combined with sulphur may be more safely and advantageously carried on.

Specification in pursuance of the conditions of the letters patent filed by the said James Childs in the Great Seal Patent Office on the 21st July, 1859.

To all to whom these presents shall come, I, James Childs, of Windsor House, Windsor Road, Putney, in the county of Surrey, send greeting:

Whereas her most Excellent Majesty Queen Victoria, by her letters patent bearing date the twenty-first day of January, in the year of our Lord one thousand eight hundred and fifty-nine, in the twenty-second year of her reign, did, for herself, her heirs and successors, give and grant unto me, the said James Childs, her special license that I, the said James Childs, my executors, administrators, and assigns, or such others as I, the said James Childs, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an invention for "an improvement in applying heat in the manufacture of artificial gums and teeth, and other articles composed of India rubber or gutta-percha combined with sulphur," upon the condition (amongst others) that I, the said James Childs, my executors or administrators, by an instrument in writing under my or their or one of their hands and seals, should particularly describe and ascertain the nature of the said invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said letters patent:

Now know ye, that I, the said James Childs, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say:

This invention has for its object an improvement in applying heat in the manufacture of artificial gums and teeth, and other articles
713 composed of India rubber or gutta-percha combined with sulphur, and consists in applying for this purpose superheated steam, that is to say, steam of a higher temperature than is due to its pressure; by thus employing steam of low pressure, and obtaining the requisite high temperature by surcharging the steam with heat, the process of converting India rubber and gutta-percha combined with sulphur may be more safely and advantageously carried on. When making artificial gums and teeth of a composition of India rubber or gutta-percha and sulphur, the moulded gums or teeth, or a combination of gums and teeth, are secured between plaster of Paris casts or moulds of the mouth they are intended to fit, and in this state they are placed in a suitable vessel capable of being externally heated, and this I prefer to do by gas jets, though heat may be otherwise applied. The vessel (which is provided with a man-hole) is in connection with a steam boiler, so that it can be kept full of steam, and such steam when in the vessel is then further heated up to the high degree of heat requisite for producing the well-known hardening effect consequent on high temperatures being applied to India rubber and gutta-percha when combined with sulphur. In like manner, other articles of India rubber or gutta-percha combined with sulphur may, when held in suitable moulds or forms, be introduced into a vessel, which is then filled with steam and heated externally. In place of or in addition to the steam being heated in the vessel in which the articles are placed, it may, after it leaves the boiler, be heated in its way to and before getting into the vessel.

Having thus stated the nature of my said invention, I will proceed more fully to describe the manner of performing the same. It is well known that India rubber and gutta-percha, when mixed with sulphur in certain proportions and subjected to high temperatures, are rendered permanently elastic or converted into hard compounds, and such hard compounds have before been applied in the manufacture of artificial gums and teeth, and also in the making of a great variety of other articles, elastic or non-elastic as required, and various modes have before been resorted to for applying the heat to such articles requisite to produce the change which renders such compounds permanently elastic, or into a hard condition resembling horn or bone.

Among other methods of applying the requisite temperature to such compounds, saturated steam of very high pressure has been resorted to, the use of which is subject to considerable difficulty, and is dangerous. Now, according to my invention, I employ steam of comparatively low pressure, which is, when out of contact with water, heated to the requisite high degree of temperature known to be necessary for converting articles made of the compounds above mentioned into the elastic or the hard or bone or horn-like condition as may be required.

714 The drawing shows a section of an apparatus suitable for the application of superheated steam, as above mentioned. *a* is a boiler or steam generator, which is supplied with water at the pipe *b* by a pump or other convenient means; *c* is a safety-valve; *d* is a steam pipe to supply steam to the vessel *e*. The steam boiler is heated by gas jets from a gas supply pipe, on which is a cock to regulate the heat. The vessel *e* is also heated by gas jets from the gas supply pipe, as shown, which has a cock to regulate the quantity of gas passing to the jets under the vessel *e*. The vessel or apparatus *e* is provided with a tube, *f*, to contain a thermometer, so that the heat of the interior of the vessel may be observed and regulated to the degree requisite. The articles to be heated (usually contained in suitable moulds) are introduced into the vessel or apparatus *e* through the opening e^1, and they are placed on the false perforated bottom e^2, under which the steam pipe from the boiler *a* is introduced into the apparatus *e*, and such pipe is coiled and perforated with numerous small holes. The opening e^1 is closed and the cover kept closely shut, as shown, or by other convenient means; e^3 is a safety-valve which I prefer to use, but it is not essential so long as the one on the boiler acts freely. The under part of the vessel *e* being heated as above explained, the steam will become further heated in this vessel, that is to say, to a temperature exceeding the natural temperature of the steam in the vessel *a*. The apparatus *e* may at its upper parts and sides be clothed over with non-conducting materials to prevent the escape of heat, and such is also the case in respect to the boiler; e^4 is a cock to draw off any water resulting from the condensation of the steam.

I would remark that the form or construction of the apparatus *e* may be varied, and it may be placed at a greater or less distance from the boiler or generator which may be used to supply steam thereto, and the steam may be heated as it passes from the boiler or generator, and before passing into the apparatus *e*, and in such manner, if desired, as not to require the vessel or apparatus *e* to be also heated, but I prefer the arrangement shown in the drawing. I would also remark, that although a separate generator may be employed to ensure that the pressure of the steam should never exceed that which is perfectly safe, such separate generator may be dispensed with when using superheated steam according to my invention. When I dispense with the use of a separate

steam generator, then I introduce into the other vessel about as much water as will, when it is vaporized, fill the vessel with steam of a pressure such as I wish to employ, and I use a safety-valve weighted to the desired pressure. By these means the vessel, when heat is applied thereto, will generate steam, and any excess will go off by the safety-valve, and the remaining atmosphere of steam contained in the vessel will then become heated up to the high degree of heat
715 desired, without so increasing the pressure as to be liable to injure the vessel.

Figure 2 is a longitudinal section of an apparatus suitable to be used in the manner above described. *a*, *a*, is an exterior cylinder of wrought iron resting on feet a^1, a^1; into the top of this cylinder a vessel *b* drops the flange at the top of this vessel resting on the edge of the cylinder *a*. The vessel *b* is furnished with a cover, which can be fastened down so as to make a steam-tight joint; *c* is a safety-valve, and *d* a thermometer passing through the top of the vessel *b*; *e* is a gas burner for heating the vessel *b*; the supply of gas to the burner is regulated by suitable taps.

In place of heating the vessel with gas in this manner, other methods of applying heat may be resorted to, but I prefer gas, as it is most conveniently applied and regulated. It is preferred to make the vessel *b* of cast iron, as this material is not liable to be acted on to a prejudicial extent by the sulphuretted hydrogen liberated in the converting process. The articles to be converted, either enclosed in moulds or otherwise according to the nature of the articles, are placed in the vessel *b*, together with a small quantity of water, and the cover is fixed on and the safety-valve weighted to the pressure it is desired to apply; the gas is then lighted under the vessel *b*, and steam generated in the vessel. When the pressure of the steam is sufficient, it raises the safety-valve *c*, and the steam continues to blow off till all the water is evaporated; when this is the case the valve closes and the steam begins to be superheated. The thermometer should then be carefully observed as the temperature rises to the desired point, and there it is maintained by regulating the quantity of gas passing to the burner *e* by the taps on the gas pipe until the process is complete. In some cases, in place of putting an indefinite quantity of water into the vessel *b*, and allowing the surplus to blow off by the safety-valve, I only place in the vessel exactly the quantity of water which is required; thus, if the capacity of the vessel *b* is one cubic foot, and I desire a pressure of about 15 lbs. per square inch above atmospheric pressure, I place two cubic inches of water in the vessel, and if I desire a pressure of 30 lbs., I place three cubic inches of water in the vessel, and so on; the increase of pressure produced by the heat, after all the water is evaporated, is comparatively small. The pressure of steam in the vessel I prefer to keep at about ten to twenty pounds on the square inch, or a greater pressure may with advantage be employed if the articles to be converted are of large size, or a very hard material be required; this, however, may be varied.

The composition of India rubber or gutta-percha and sulphur may be such as have heretofore been employed, and the degree of heat employed, and the duration of the process, will be the same as when
716 saturated steam at a high pressure is employed, as has been common; the construction of the moulds, when moulds are employed for containing the articles, will also be as heretofore.

In witness whereof, I, the said James Childs, have hereunto set my

hand and seal, this twenty-first day of July, in the year of our Lord one thousand eight hundred and fifty-nine.

JAMES CHILDS. [L. S.]

We hereby certify the above (letter-press only) to be a true copy.

SAMUEL CASSERLEY,
H. A. CHEESWRIGHT,
Clerks in the Patent Office.

717 A. D. 1859, 11th June. No. 1421.

Manufacture of artificial teeth. Letters patent to George Claudius Ash, of West View, Hampstead, in the county of Middlesex, for the invention of "improvements in the manufacture of artificial teeth." Sealed the 25th of November, 1859, and dated the 11th June, 1859.

Provisional specification left by the said George Claudius Ash at the office of the Commissioner of Patents, with his petition, on the 11th June, 1859.

I, George Claudius Ash, of West View, Hampstead, in the county of Middlesex, do hereby declare the nature of my invention for "improvements in the manufacture of artificial teeth" to be as follows:

This invention has for its object improvements in the manufacture of artificial teeth. When what are called mineral teeth, that is, teeth moulded in a description of porcelain, are set in a base of a material which is moulded on to the teeth, and afterwards hardened (such as vulcanite, which is a material now commonly used), difficulty is found in obtaining a complete adhesion between the teeth and the base, in consequence of the surfaces or parts of the teeth with which the vulcanite comes in contact being highly polished.

Now according to this invention I apply to the teeth before they are fired, at the parts with which the base is to come in contact, a coating of powdered silica or other refractory substance which will not run into a glaze during the firing, or a roughened surface may be given to such parts of the tooth as come in contact with the base by grinding, or by the action of fluoric acid, after the tooth has been fired. I prefer, however, the method first mentioned. Mineral teeth, such as have heretofore been set in vulcanite base, have usually been formed with metal pins projecting from the back of the tooth, and by these pins the tooth is attached to the vulcanite base, or in some cases the back of the tooth has been formed with a dovetailed ridge or projection with the same object; but teeth thus constructed are liable to become detached from a vulcanite base, in consequence of the elasticity of the material. Now, to obtain a more secure connection between the vulcanite base and the teeth, I furnish each tooth both with projections and pins, in place of one of these only, as heretofore.

718 Specification in pursuance of the conditions of the letters patent filed by the said George Claudius Ash in the Great Seal Patent Office on the 10th December, 1859.

To all to whom these presents shall come, I, George Claudius Ash, of West View, Hampstead, in the county of Middlesex, send greeting:

Whereas Her most Excellent Majesty Queen Victoria, by her letters patent, bearing date the eleventh day of June, in the year of our Lord one thousand eight hundred and fifty-nine, in the twenty-second year of her reign, did, for herself, her heirs and successors, give and grant unto

me, the said George Claudius Ash, her special license that I, the said George Claudius Ash, my executors, administrators, and assigns, or such others as I, the said George Claudius Ash, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britian and Ireland, the Channel Islands, and Isle of Man, an invention for "improvements in the manufacture of artificial teeth," upon the condition (amongst others) that I the said George Claudius Ash, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said letters patent:

Now know ye, that I, the said George Claudius Ash, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say:

This invention has for its object improvements in the manufacture of artificial teeth. When what are called mineral teeth, that is, teeth moulded in a description of porcelain, are set in a base of a material which is moulded on to the teeth and afterwards hardens (such as vulcanite, which is a material now commonly used), difficulty is found in obtaining a complete adhesion between the teeth and the base, in consequence of the surfaces or parts of the teeth with which the vulcanite comes in contact being highly polished.

Now, according to this invention, I apply to the teeth before they are fired, at the parts with which the base is to come in contact, a coating of powdered silica or other refractory substance which will not run into a glaze during the firing; this I prefer to do by mixing finely powdered silica (which is conveniently obtained by pounding rock crystal) with gum water to the consistency of thick cream, and applying it with a
719 brush to such parts of the tooth as it is desired to render rough; this should be done when the tooth is ready for firing. Calcined magnesia may be employed in place of silica, but not so advantageously; or a roughened surface may be given to such parts of the tooth as come in contact with the base by grinding; this is best done by touching the tooth after it has been fired on a small grindstone of fine texture revolving at a considerable velocity. It is not possible by this process, however, to roughen the surface so completely as by the application of a refractory powder, as above described, the forms of teeth being such that it is generally impossible to bring every portion of the surface which it is desired to roughen in contact with the stone. Portions of the surface of a tooth may also be roughened, after the tooth has been fired, by submitting it to the action of fluoric acid; this may be done by coating with wax the portions of the surface of the tooth over which it is desired to preserve the glaze, and then exposing the tooth to the action of fluoric acid vapor generated by the action of sulphuric acid on fluor spar, in the manner in which glass is commonly etched. I prefer, however, the method first mentioned. Mineral teeth, such as have heretofore been set in a vulcanite base, have usually been formed with metal pins projecting from the back of the tooth, and by these pins the tooth is attached to the vulcanite base, or in some cases the back of the tooth has been formed with a dovetailed ridge or projection with the same object, but teeth thus constructed are liable to become detached from a

vulcanite base in consequence of the elasticity of the material. Now, to obtain a more secure connection between the vulcanite base and the teeth, I furnish each tooth with projections and pins in place of one of these only, as heretofore.

Figures 1, 2, and 3, of the annexed drawing, show, respectively, a back view, side view, and horizontal section of a tooth so constructed. *a* is the ridge or projection, and *b*, *b*, are metal pins inserted into the substance of which the tooth is composed before it is fired; Figures 4, 5, and 6 show similar views of another tooth, in which two projections *a*, *a*, are employed, one on each side with a single pin *b* between them. The Figures 7 and 8 show other teeth of slightly modified form.

In witness whereof I, the said George Claudius Ash, have hereunto set my hand and seal, this tenth day of December, in the year of our Lord one thousand eight hundred and fifty-nine.

G. C. ASH. [L. S.]

We hereby certify the above (letter-press only) to be a true copy.

SAMUEL CASSERLEY,
H. A. CHEESWRIGHT,
Clerks in the Patent Office.

720 A. D. 1859, 9th August. No. 1842.

Coloring and hardening elastic gums for dental purposes. Letters patent to Frederic Louis Lawrence, of 50 Berners street, Oxford street, in the county of Middlesex, dentist, for the invention of "Improvements in coloring and hardening elastic gums for dental purposes." Sealed the 22nd November, 1859, and dated the 9th August, 1859.

Provisional specification left by the said Frederic Louis Lawrence at the office of the Commissioners of Patents, with his petition, on the 9th August, 1859.

I, Frederic Louis Lawrence, of 50 Berniers street, Oxford street, in the county of Middlesex, dentist, do hereby declare the nature of the invention for "improvements in coloring and hardening elastic gums for dental purposes" to be as follows:

This invention consists in coloring to the required tint the elastic gums used by dentists, and hardening them for the purposes of being used in lieu of gold or bone at present in use. I take caoutchouc, sulphur, oxide of zinc, and cinibar (vermillion) in certain proportions, and pass them together through grinding rollers or masticating apparatus until thoroughly incorporated or blended. The proportions which are believed to be most suitable are at the rate of about 3½ lbs. of caoutchouc, 1½ lbs. of sulphur, 1 lb. of vermillion, 9½ lbs. of oxide of zinc, but these proportions may be varied. The compound is to be moulded as heretofore when using compounds of caoutchouc for dental purposes, and subjected to heat, as is well understood, to obtain the desired hardness, after which it is polished by any known means, and then placed in a closed glass vessel containing alcohol or other suitable liquid, and subjected to solar light, which brings the required flesh color to the surface. By this means the material will be found better suited to answer the purpose of bone or gold.

Specification in pursuance of the conditions of the letters patent filed by the said Frederick Louis Lawrence in the Great Seal Patent Office on the 8th February, 1860.

To all to whom these presents shall come: I, Frederic Louis Lawrence, of 50 Berniers street, Oxford street, in the county of Middlesex, dentist, send greeting:

721 Whereas her most excellent Majesty Queen Victoria, by her letters patent, bearing date the ninth day of August, in the year of our Lord one thousand eight hundred and fifty-nine, in the twenty-third year of her reign, did, for herself, her heirs and successors, give and grant unto me, the said Frederick Louis Lawrence, her special license that I, the said Frederick Louis Lawrence, my executors, administrators, and assigns, or such others as I, the said Frederick Louis Lawrence, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an invention for "Improvements in coloring and hardening elastic gums for dental purposes," upon the condition (amongst others) that I, the said Frederic Louis Lawrence, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said letters patent:

Now know ye, that I, the said Frederick Louis Lawrence, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say:

This invention consists in coloring to the required tint the elastic gums used by dentists, and hardening them for the purpose of being used in lieu of gold or bone at present in use. I take caoutchouc, sulphur, oxide of zinc, and cinnibar (vermillion), in certain proportions, and pass them together through grinding rollers or masticating apparatus until thoroughly incorporated or blended. The proportions which are believed to be most suitable are at the rate of about 3½ lbs. of caoutchouc, 1½ lbs. of sulphur, 1 lb. of vermillion, 9½ lbs. of oxide of zinc, but these proportions may be varied. The compound is to be moulded as heretofore when using compounds of caoutchouc for dental purposes, and subjected to heat, as is well understood, to obtain the desired hardness; after which it is polished by any known means, and then placed in a closed glass vessel containing alcohol or other suitable liquid, and subjected to solar light, which brings the required flesh color to the surface. By this means the material will be found better suited to answer the purpose of bone or gold.

Having thus stated the nature of my invention, I will proceed more fully to describe the manner of performing the same.

722 Sulphur compounds of india-rubber (caoutchouc) have before been used by dentists in preparing artificial gums and palates, but the color thereof has not been satisfactory.

The object of my invention, as above stated, is to obtain a better or more natural color than has heretofore been obtained when using sulphur compounds of india-rubber hardened by heat for dental purposes. The proportions of the substances above mentioned may be varied, but

I believe those above given are the most convenient. When the compound has been prepared, the same is used in the plastic state, and is moulded into the proper form in like manner to that heretofore resorted to when using sulphur compounds of india-rubber in the production of artificial gums or palates, and the moulded gums or palates with the teeth, whilst retained in the moulds, are subjected to heat to produce the change as heretofore, and as is well understood. The hardened artificial gums or palates when cold and polished are immersed in alcohol, and placed in a position where the sun's rays will act thereon, by which the color of the india-rubber compound will be changed, and the desired effect produced.

In witness whereof I, the said Frederick Louis Lawrence, have hereunto set my hand and seal, this fourteenth day of October, in the year of our Lord one thousand eight hundred and fifty-nine.

FREDERICK L. LAWRENCE. [L. S.]

We hereby certify the above to be a true copy.

SAMUEL CASSERLEY,
H. A. CHEESWRIGHT,
Clerks in the Patent Office.

723 **A. D. 1859, 8th October. No. 2295.**

Manufacture of artificial gums. Letters patent to James Childs, of Windsor House, Putney, in the county of Surrey, for the invention of "Improvements in the manufacture of artificial gums." Sealed the 23d March, 1860, and dated the 8th October, 1859.

Provisional specification left by the said James Childs at the office of the Commissioners of Patents, with his petition, on the 8th October, 1859.

I, James Childs, of Windsor House, Putney, in the county of Surrey, do hereby declare the nature of the invention for "improvements in the manufacture of artificial gums" to be as follows:

This invention has for its object improvement in the manufacture of artificial gums, and is applicable when what is now known as "dental rubber" (a compound of India rubber, sulphur, and vermilion) is used in this manufacture. In order to obtain a better and more natural color to those parts of the artificial gums which are visible when the gums are in use, a substance or compound is employed for making these parts different from that which is employed in making the other or main parts or body of the artificial gums. Thus, a compound may be employed for the outer surfaces of the gums which, although of a good and natural color, is too weak or brittle to be used alone, while the main body of the gums is composed of a stronger compound.

The introduction of coloring and other foreign matters into dental rubber in all cases weaken such compounds. To form the body of the gums, I prefer to use light compounds of India rubber, sulphur, and vermilion, to those usually employed, but variations may be made therein, and for the surfaces of the gums a different compound is employed; it may be a compound of India rubber or gutta-percha, or of the two together, combined with sulphur and coloring or other foreign matters. I prefer to use compounds such as are described in the provisional specification of Frederick Louis Lawrence, dated the 9th day of August, 1859 (No. 1842), and to treat the artificial gums, when hardened, by subjecting them to the action of spirit and light, as therein

described, by which the surface material will be brought to the desired color.

My invention, however, does not consist in the use of any peculiar compound of India rubber gums, when employing compound India rubber and sulphur, hardened by heat, in the manufacture of artificial gums, but in using a different material or compound of India rubber for the outer surfaces or parts of the gums to that which is used in producing the other parts or main body of the same.

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In moulding a set of artificial gums, a thin layer of the surface material is first introduced into the mould, and then the mould is filled with the ordinary or different compound of India rubber and sulphur, taking care that, whatever be the other material used, it will adhere to the India rubber compound of which the body is formed. The artificial gums thus moulded are then hardened by the application of heat, as is well understood.

In using compounds of India rubber (caoutchouc) in the making of artificial gums, I, in some cases, use frames of wire or metal, having wires or projections fixed to them, for the purpose of attaching the teeth. The frames of wire or metal are introduced into the moulds, and incorporated within the compound of India rubber and sulphur, of which the bodies of the artificial gums are composed. By these means greater strength may be obtained when constructing artificial gums of India rubber compounds.

I would here remark that it is not new to use frames of metal in moulded artificial gums when made of gutta-percha; but the peculiarity of this part of the invention consists in combining such metal frames with hardened compounds of India-rubber in the manufacture of artificial gums.

Specification in pursuance of the conditions of the letters patent filed by the said James Childs in the Great Seal Patent Office on the 7th April, 1860.

To all to whom these presents shall come, I, James Childs, of Windsor House, Putney, in the county of Surrey, send greeting:

Whereas her most excellent Majesty Queen Victoria, by her letters patent bearing date the eighth day of October, in the year of our Lord one thousand eight hundred and fifty-nine, in the twenty-third year of her reign, did, for herself, her heirs, and successors, give and grant unto me, the said James Childs, her special license that I, the said James Childs, our executors, administrators, and assigns, or such others as I, the said James Childs, my executors, administrators, and assigns, should at any other time agree with, and no others, from time to time, and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an invention for "Improvement in the manufacture of artificial gums," upon the condition (amongst others) that I, the said James Childs, my executors, or administrators, by an instrument in writing under my or their hands and seals, should particularly describe and ascertain the nature of the said invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said letters patent:

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Now know ye that I, the said James Childs, do hereby declare the na-

ture of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say:

This invention has for its object improvements in the manufacture of artificial gums, and is applicable when what is now known as "dental rubber" (a compound of India rubber, sulphur, and vermilion) is used in this manufacture. In order to obtain a better and more natural color to those parts of the artificial gums which are visible when the gums are in use, a substance or compound is employed for making these parts different from that which is employed in making the other or main parts or body of the artificial gums. Thus a compound may be employed for the outer surfaces of the gums which, although of a good and natural color, is too weak or brittle to be used alone, whilst the main body of the gums is composed of a stronger compound. The introduction of coloring and other foreign matters into dental rubber in all cases weakens such compounds. To form the body of the gums, I prefer to use like compounds of India rubber, sulphur, and vermilion to those usually employed; but variations may be made therein, and for the surfaces of the gums a different compound is employed; it may be a compound of India rubber, or of gutta-purcha, or of the two together, combined with sulphur and coloring or other foreign matters.

I prefer to use a compound consisting of—

6 or 8 parts by weight of caoutchouc,
2 parts " of sulphur,
6 parts " of vermilion,
12 parts " of silicate of magnesia.

Or, 6 or 8 parts by weight of caoutchouc,
2 parts " of sulphur,
5 parts " of vermilion,
12 parts " sulphate of lime.

Other proportions of these matters may be used, and magnesia may be employed in place of silicate of magnesia, and, in place of or
726 in combination with India rubber, gutta-percha may be used, and other light or white substances, as well as other coloring matters may be used in place of or in combination with those mentioned above, such as oxides of zinc.

My invention, however, does not consist in the use of any peculiar compound of India rubber, when employing compound India-rubber and sulphur, hardened by heat, in the manufacture of artificial gums, but in using a different material or compound of India-rubber or of gutta-percha for the outer surfaces or parts of the gums which come in sight when in use to that which is used in producing the other parts or main body of the same.

In moulding a set of artificial gums, a thin layer of the surface material is first introduced into the mould, and then the mould is filled with the ordinary or different compound of India-rubber and sulphur, taking care that, whatever be the outer material used, it will adhere to the India-rubber compound of which the body is formed. The artificial gums thus moulded are then hardened by the application of heat, as is well understood; or, in place of proceeding in the manner above described, I first mould and harden the gums in the manner heretofore practiced, and afterwards I roughen such parts as it is desirable to coat with a material of different color. To the parts thus roughened I apply a composition such as that already described, the composition being warmed, so as to make it as plastic as possible, and being applied

with care, so that its adhesion to the original gum may be complete; the whole is then enclosed in plaster and submitted to the hardening process.

In using compound of India-rubber (caoutchouc) in the making of artificial gums, I in some cases use frames of wire or metal, having wires or projections fixed to them for the purpose of attaching the teeth. The frames of wire or metal to which the teeth are fixed are introduced into the moulds and surrounded with the compound of India-rubber and sulphur, of which the bodies of the artificial gums are composed; the teeth at the same time will be surrounded by the dental India rubber compounds, which will form sockets for the teeth. By these means greater strength may be obtained when constructing artificial gums of India rubber compounds than heretofore, where the teeth have been simply fixed by metal pins to the India rubber compound.

I would here remark that it is not new to use frames of metal in moulded artificial gums, frames similar to those which I employ having before been used in combination with gutta-percha; but the peculiarity of this part of the invention consists in combining such metal frames with hardened compounds of India rubber in the manufacture of artificial gums.

727 Artificial gums made as above explained may be used in the state in which they are produced; but they may, when desired, be varnished with a spirit varnish, in which case I prefer to use a solution of collodion as the varnish, which may be colored to any desired tint.

In witness whereof I, the said James Childs, have hereunto set my hand and seal this sixth day of April, in the year of our Lord one thousand eight hundred and sixty.

JAMES CHILDS. [L. S.]

We hereby certify the above to be a true copy.

SAMUEL CASSERLEY,
H. A. CHEESEWRIGHT,
Clerks in the Patent Office.

728 A. D. 1859, 8th December. No. 2790.

Setting artificial teeth. Letters patent to John Macintosh, of 40, North Bank, Regent's Park, in the county of Middlesex, for the invention of "Improvements in setting artificial teeth." Sealed the 4th May, 1860, and dated 8th December, 1859.

Provisional specification left by the said John Macintosh at the office of the commissioners of patents with his petition, on the 8th December, 1859.

I, John Macintosh, of 40, North Bank, Regent's Park, in the county of Middlesex, do hereby declare the nature of the invention for "improvements in setting artificial teeth" to be as follows:

This invention has for its object improvements in setting artificial teeth. For this purpose I employ collodion (or a solution of gun-cotton or fibre in a solvent); this material I apply to the teeth to be set when in a fluid or soft state, so that when it hardens the teeth may become securely imbedded in it. A form or mould is by preference employed to bring the mass of collodion in which the teeth are set to the proper shape to fit the mouth. Cotton or other fibre may be imbedded in the collodion to increase its toughness, and the outer surface or the whole of the collodion may be colored to look like the natural gum.

Specification in pursuance of the conditions of the letters patent filed by the said John Macintosh in the Great Seal Patent Office on the 8th June, 1860.

To all to whom these presents shall come, I, John Macintosh, of 40, North Bank, Regent's Park, in the county of Middlesex, send greeting:

Whereas Her Most Excellent Majesty Queen Victoria, by her letters patent bearing date the eighth day of December, in the year of our Lord, one thousand eight hundred and fifty-nine, in the twenty-third year of her reign, did for herself, her heirs and successors, give and grant unto me, the said John Macintosh, her special license that I, the said John Macintosh, my executors, administrators, and assigns, or such others as I, the said John Macintosh, my executors, adminis-
729 trators, and assigns should at any time agree with and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an invention for "Improvements in setting artificial teeth," upon the condition (amongst others) that I, the said John Macintosh, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said letters patent.

Now know ye that I, the said John Macintosh, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say:

This invention has for its object improvements in setting artificial teeth, and consists in employing for this purpose the preparation known by the name of collodion, which is a solution of gun-cotton or fibre in a solvent. The following is the manner in which I prefer to proceed: I obtain in the usual manner an impression in wax of the form of the jaw of the person for whom the set of artificial teeth is to be made, and from this I make a mould in plaster, as is well understood. Into this mould I again cast plaster, and so obtain in plaster a copy of the original wax impression of the jaw. On to this form I build up in wax or other material a thickness equal to that of the collodion setting which it is desired to produce, and the teeth to be set are imbedded in the wax in the same manner as they are to be in the collodion setting; when this is produced on the wax model, and while it is still on the form it is oiled all over and a plaster cast is taken of it. This when set is removed from the form, and the teeth will be found firmly imbedded in it, the whole of the wax is then carefully removed. Thus two plaster forms are obtained, which, when put together, form a mould, and enclose between them a space corresponding in form with the collodion setting to be produced. These forms are placed in a metal box, such as is used in the vulcanite process, which is well understood by dentists, and they are secured the one in the top and the other in the bottom of the box by running them in with plaster. The collodion to be employed may be prepared in the ordinary manner. And I prefer, in order to increase its toughness, to mix with it a small quantity of short cotton fibre, and I evaporate the solvent until the collodion is brought to a plastic and putty-like state. If it be desired to obtain a hard setting, I add to the collodion and thoroughly incorporate with it powdered gum copal

730 in quantity varying according to the hardness desired. If great hardness is required I employ as much as 20 per cent. The collodion whilst still warm I carefully press into the mould around the teeth, as in filling a mould with the compound of India-rubber and sulphur in making teeth of vulcanite, as is well understood. I then place the two parts of the mould together, and force them together by means of the screw with which the box containing them is fitted. Thus the collodion between the two parts of the mould is forced into every crevice of it, and in order that the collodion may remain thoroughly plastic the mould is kept heated to about 200° Fahrenheit. When the two parts of the mould are pressed close together, the mould is allowed to cool, and when cold, the teeth with the setting, which is then complete, are removed. If it is necessary in order to render the fit of the setting more complete, parts of it may afterwards be pared away, as has before been practiced when settings of other material have been employed. In order that the teeth may be securely held by the setting, they may be notched or under-cut in a similar manner to the teeth now employed for setting in vulcanite. And I prefer to form the teeth with a hole or passage up the centre of each, which at the base is opened out as wide as the tooth will admit of without becoming unduly weakened. These holes or passages I fill with collodion, singly or in the process of filling the mould, so that when the setting is finished each tooth will have a stem of collodion forming part of the setting passing up its centre, and the teeth thus become firmly held, or they may be attached to the setting by pins, as is well understood. I color the collodion to make it resemble the natural gum by means of alkanet root, the whole of the collodion may be thus colored while in a liquid state; or the setting, when finished, may have a coating of colored collodion applied to its surface. If it be desired to obtain a plate or thin flexible setting, I proceed in a similar manner to that already described, but I produce the two forms of which the mould consists in a readily fusible metal (a mixture of tin and lead answers well) in place of in plaster as before described; but in this case, after producing the wax model the teeth are not left in it whilst the the plaster cast is taken, but are first carefully removed. The collodion is formed into a sheet of the desired thickness, and there is cut out from this sheet, with the assistance of a template previously prepared by measuring from the mold a piece of suitable form to produce the setting. I then lay the piece of sheet collodion, previously rendered plastic by heat, in its place in one-half of the mould, and the other half is then put over the first and pressed firmly down upon it by the use of a screw box, as before explained. The mould is heated to about 200° Fahrenheit, so as to keep the collodion perfectly plastic, and the pressure applied is sufficient to force the collodion into every crevice of the mould. When the mould is cold and the collodion is set, the collodion plate is
731 removed. The teeth are afterwards fitted in their places on the plate, and are fixed either by metal pins, or as is preferred, the teeth are, as before mentioned, made with a passage up the centre which is filled with collodion, and afterwards the collodion in the tooth and the plate at the part where the tooth is to be fixed are both moistened with ether, and they are pressed in contact till the solvent evaporates, when they will be found firmly attached the one to the other.

Collodion may also be employed for setting in the same manner as sea-horse tooth is employed, and as is well understood by dentists. In this case a block of collodion (mixed with fibre and copal if considered desirable) is formed and afterwards carved out to the form desired, the teeth being fitted and fixed as when sea-horse tooth is employed.

Collodion, as a setting of teeth, has this advantage over many of the substances heretofore employed, that it does not decompose and become fœtid in the course of long exposure in the mouth; it is also free from the metallic taste which all metal has more or less; it is not liable to lacerate the gums, and is not easily detected when in use.

In witness whereof I, the said John Macintosh, have hereunto set my hand and seal this eighth day of June, in the year of our Lord one thousand eight hundred and sixty.

JOHN MACINTOSH. [L. S.]

We hereby certify the above to be a true copy.

J. STUART S. SCOTT,
H. A. CHEESWRIGHT,
Clerks in the Patent Office.

732 A. D. 1860, 2d January. No. 4.

Applying India rubber as the basis of artificial teeth. Letters patent to Henry Andrew Dewar, of Union street, Aberdeen, North Britain, M. D., for the invention of "Improvements in moulding or applying India rubber as the basis of artificial teeth, and in apparatus for the same." Sealed the 29th June, 1860, and dated the 2d January, 1860.

Previsional specifications left by the said Henry Andrew Dewer at the office of the commissioners of patents, with his petition, on the 2d January, 1860.

I, Henry Andrew Dewar, of Union street, Aberdeen, North Britain, M. D., do hereby declare the nature of the said invention for "improvements in moulding or applying India rubber as the basis of artificial teeth, and in apparatus for the same," to be as follows:

I employ the ordinary apparatus used in the application of India rubber as the basis of artificial teeth, with some slight modifications, and apply thereto apparatus according to and necessary for carrying out my invention. I place the cast of the jaw requiring teeth in the lower part of the apparatus or moulding flask, and on this I set the artificial teeth as usual, but instead of adjusting them with gutta percha and wax, I do so with wax alone; this done, I now place the middle part of the flask in position, and run it full of plaster, but before doing so I place a stick of wax in connection with the wax of the set contained in the flask. This stick of wax stands up and projects through a hole which I form in the top of the flask. Two small holes are also formed in the intermediate piece of the flask, and I place therein two or more pieces of wire, the ends of which in one direction touch the wax of the set, while the ends in the opposite direction project through the flask. The cover being placed on the flask, and the whole secured together, I turn it upside down on a plate or receiver, and place it in an oven at a sufficient temperature to melt the wax setting, which runs out by the hole formed by the wax stick before mentioned. I now remove the small wires, and place the flask while still hot in connection with my apparatus, with which I fill in and pack the India rubber in the mould so obtained.

733 This apparatus consists of a cylinder fitted with a piston, worked by a screw lever or other suitable power; the cylinder is furnished with a jacket, in which I admit steam or other heating medium. I place the prepared India rubber (the same as usually employed for the purpose) in the cylinder, and allow it sufficient time to be reduced to the softened or plastic state necessary. This apparatus

being suitably fixed to the flask, and having the opening in the bottom of the cylinder in coincidence with the hole in the top of the flask, I then force down the piston of the cylinder, thus forcing the India rubber to enter the mould, and so assume the form of the set required and as vacated by the wax; when the India rubber is forced out at the small holes or gates before mentioned the packing is complete. I then remove the packing apparatus, and apply the ordinary means of holding the flask together, at same time applying a plug pad to the hole in the top to stop it, and against which the binding screw of the stirrip or fixing strap abuts. The moulded set or base is then ready to be vulcanized, as well understood.

Instead of melting the wax out of the mould in an oven, it may be effected by currents of hot air or steam, or by a hot alkaline solution being forced through.

Specification in pursuance of the conditions of the letters patent filed by the said Henry Andrew Dewar in the great seal patent office on the 2d July, 1860.

To all to whom these presents shall come, I, Henry Andrew Dewar, of Union street, Aberdeen, North Britain, M. D., send greeting:

Whereas her most Excellent Majesty Queen Victoria, by her letters patent bearing date the second day of January, in the year of our Lord one thousand eight hundred and sixty, in the twenty-third year of her reign, did, for herself, her heirs and successors, give and grant unto me, the said Henry Andrew Dewar, her special license that I, the said Henry Andrew Dewar, my executors, administrators, and assigns, or such others as I, the said Henry Andrew Dewar, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britian and Ireland, the Channel Islands, and Isle of Man, an invention for "improvements in moulding or applying India rubber as the basis of artificial teeth and in apparatus for the same," upon the condition (amongst others) that I, the said Henry Andrew Dewar, my executors or administrators, by an instrument
734 in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said invention, and in what manner the same was to be performed, and cause the same to be filed in the great seal patent office within six calendar months next and immediately after the date of the said letters patent:

Now, know ye that I, the said Henry Andrew Dewar, do hereby declare the nature of my said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, reference being had to the sheet of drawings hereunto annexed, and to the letters and figures marked thereon (that is to say):

I employ ordinary apparatus used in the application of India rubber as the basis of artificial teeth, with some slight modifications, and apply thereto apparatus according to and necessary for carrying out my invention. I place the cast of the jaw requiring teeth in the lower part of the apparatus or moulding flask; and on this I place the artificial teeth as usual, but instead of adjusting them with gutta percha and wax, I do so with wax alone; this done, I now place the middle part of the flask in position, and run it full of plaster, but before doing so I place a stick of wax in connection with the wax of the set contained in the flask. The stick of wax stands up and projects through a hole

which I form in the top of the flask. Two small holes are also formed in the intermediate piece of the flask, and I place therein two or more pieces of wire, the ends of which towards the centre touch the wax of the set, while the other ends project through the flask. The cover being placed on the flask, and the whole secured together, I turn the whole upside down on a plate or receiver, and place it in an oven at a sufficient temperature to melt the wax of the setting, which runs out by the hole formed by the wax stick before mentioned. I now remove the small wires and place the flask while still hot in connection with my apparatus, with which I fill in and pack the India rubber in the mould so obtained.

This apparatus consists of a cylinder fitted with a piston worked by a screw, lever, or other suitable power; the cylinder is furnished with a jacket, in which I admit steam or other heating medium. I place the prepared India rubber (the same as usually employed for the purpose) in the cylinder, and allow it sufficient time to be reduced to the softened or plastic state necessary. This apparatus having been suitably fixed to the flask with the ejection aperture in the bottom of the cylinder in coincidence with the opening in the top of the flask, I then force down the piston of the cylinder, thereby forcing the India rubber to enter the mould, and to assume the form of the setting required and as vacated by the wax; when the India rubber is forced out at the small holes or vents before mentioned, the packing is complete. I now remove the
735 packing apparatus, and apply the ordinary means of holding the flask together, at same time applying a plug or pad to the hole in the top to stop it, and against which the binding screw of the stirrup or fixing strap abuts. The moulded set or base is then ready to be vulcanized, as well understood.

Instead of melting the wax out of the mould in an oven, as before described, it may be effected by currents of hot air or steam, or by means of a hot alkaline solution forced through the flask.

DESCRIPTION OF DRAWINGS.

The annexed drawing represents apparatus complete for the application of India-rubber as the basis of artificial teeth according to my invention.

Fig. 1 represents the whole of the apparatus in position, mounted on a suitable bench or table, A A. B B is the wrought-iron frame, fixed in a vice, C, or it may be otherwise secured; this frame B has a boss at each end fitted with screws *a*, *b;* on the screw *a* a plate or disc *d* is fitted; this may be moved towards or from its supporting boss by turning the screw therein, and as may be required. D is the flask containing the set of teeth to which the base is to be applied; it is of the ordinary form, and is clamped between plates *e* and *f*, seen separately at Figs. 2 and 3; E is the cylinder containing the rubber to be introduced, the rod *g* of whose piston is connected with or has formed on it a screw, *b*, fitted to the other boss of frame B; this screw is furnished with a suitable winch handle or lever, whereby to communicate rotatory motion to the screw, and cause the piston to traverse in its cylinder. As before mentioned, the cylinder E has a jacket casing, in which steam is introduced to dissolve or render plastic the India-rubber. In order to supply the steam, F is a small boiler, which I place on a Bunsen's burner and stand G, having a suitable supply of gas by pipe *h*. The steam generated in F passes by pipe *t*, and circulates in the jacket of the cylinder. See section, Fig. 11. H is a small portable oven, with a double bottom,

which I also mount when required on the burner and stand G. This completes the whole apparatus necessary.

In proceeding to form the vulcanite base for a set of teeth, I take the cast of the jaw to be fitted in wax in the ordinary way; I then take a model in plaster from such wax mould, and set it in plaster contained in the lower part 1 of the flask, all as in ordinary. I now mount on the plaster cast a model of the vulcanite base to be produced. This model I form of wax alone, or analogous material suited for the purpose. After fitting the teeth thereto, and also fitting it accurately to the mouth from which the cast was taken, I place it in position on the plaster cast in the part 1 of the flask, and then place part 2 of the flask in po-
736 sition, and place two or more wires, *i k* (see Fig. 4, which is a section of the flask across the jaw of the wax model), in contact with the wax at the one end, while the other end projects through the holes in the flask. I also erect a stick of wax, or it may be a thick wire, *l*, from the wax of the model, as seen also in Fig. 4; this being done, I run the flask full of plaster, and then place on it the top or cover 3. The wax model, together with the set of teeth, will now be imbedded in the plaster contained in the flask; when the plaster is sufficiently set and dry, I withdraw the wires *i*, *k*, and *l*, and invert the flask in a suitable receiver, and place it in oven H, in which it is heated till all the wax runs out by the gates or holes produced by withdrawing the wires; any wax not finding its way freely out by the gates will be absorbed by the plaster; the gates should however be in such position and of sufficient number as to insure the necessary egress for the wax. The wax being so removed, the teeth will be left in the plaster, while the space or spaces left by the wax will be void, to fill which with India-rubber is now the object to be effected. To effect this I place the flask between the plates *e* and *f*, binding them together by means of screw-dogs *m*, *m*, *m*. In the mean time the cylinder E is filled with India-rubber or combinations thereof with other material. For this purpose the piston and its rod are withdrawn, and the cylinder slewed round on the bolt *n*, on which it is mounted. Having so charged the cylinder with India-rubber, and heated it by the steam from boiler F, I return the piston to position and fix the cylinder in position in line with the frame B. I now brink up the flask D by means of screw *a*, until the flask presses hard against the nozzle *p* of the cylinder; the nozzle is of the same diameter, and opposite to the hole *q* in the cover (see Fig. 5). I now, by means of a winch handle and screw on rod *g*, cause the piston to force the plastic rubber into the hole vacated by the stick of wax or large wire *l*, from whence it distributes itself throughout the whole area originally occupied by the wax model, and also permeating the interstices or holes formed in the teeth, in order to secure them; by this means the rubber will first take the exact form of the wax model, and this being complete it will escape at the gates formed by the withdrawal of the wires *i k*, this escape indicating that the operation of packing is complete. The flask is now removed from the cylinder, a plug, *r*, placed in hole *q*, and the whole bound together by the stirrup *s*, as seen at Fig. 6. The flask is then placed in the oven and kept at a sufficient temperature to render the rubber hard, as well understood, as applied to like purposes.

Figs. 7, 8, 9, and 10 represent another arrangement of the flask. Fig. 7 represents it complete, in which it will be seen the hole *q* is at the side instead of in the cover of the flask, while the dogs *m* are two in number, and jointed to the bottom or part 1 of the flask seen in plan,
737 Fig. 8, instead of being separate, as before. Fig. 9 is the part 2, while Fig. 10 represents the top or cover. The operation is the

same with this flask, excepting that the hole or gate whereat the plastic India-rubber is introduced is in the plane of the jaw instead of perpendicular thereto, as before described. Small gates are also formed by the introduction of two or more wires, *i*, *k*, at suitable points to insure the object desired.

Instead of a piston being used to force the India-rubber into the mould, a screw or other means of expressing the plastic material may be adopted.

Fig. 12 and 13 represent end and side views of a small gas soldering or fusing iron, which I make use of in moulding and forming the wax and rubber material. It consists of a small hollow copper bit, *v*, supported on an adjustable stem, *w*, whereby it can be brought nearer to or further from the small gas jet *x*, issuing from pipe *y*, traversing the handle *z*. This pipe is furnished with a stop cock to regulate the emission of gas which is supplied through flexible pipe y^1, which affords all necessary freedom for handling the instrument. The small gas jet from *y* playing into the hole v^1 of the hollow bit raises and keeps it at the temperature required.

Fig. 14 is another form of hollow bit, to be substituted for *v*, *w*; this is simply a small hollow copper cone, into the base of which the gas jet is directed.

Having described the nature of my invention, and the manner of performing the same, I declare that what I claim as my invention to be protected by the hereinbefore in part recited letters patent, is, preparing the mould for the reception of the India-rubber base of the teeth with gates or inlet and outlet apertures, as hereinbefore described, and the forcing and moulding therein the India-rubber material in a plastic state by pressure and apparatus, as hereinbefore described.

In witness whereof I, the said Henry Andrew Dewar, have hereunto set my hand and seal this twenty-ninth day of June, in the year of our Lord one thousand eight hundred and sixty.

HENRY ANDREW DEWAR. [L. S.]

We hereby certify the above (letter-press only) to be a true copy.

SAMUEL CASSERLEY,
H. A. CHEESWRIGHT,
Clerks in the Patent Office.

738 A. D. 1860, 26th June. No. 1549.

Mouth-pieces for dental and other purposes. Letters patent to Matthew Cartwright, of No. 7 Crescent, in the city of Carlisle, in the county of Cumberland, dentist, for the invention of "Improvements in the manufacture of mouth-pieces for dental and other purposes." Sealed the 18th December, 1860, and dated the 26th June, 1860.

Provisional specification left by the said Matthew Cartwright at the office of the commissioners of patents, with his petition, on the 26th June, 1860.

I, Matthew Cartwright, of No. 7 Crescent, in the city of Carlisle, in the county of Cumberland, dentist, do hereby declare the nature of the said invention for "improvements in the manufacture of mouth-pieces for dental and other purposes" to be as follows:

At present, mouth-pieces used by dentists for the insertion of artificial teeth are formed of a composition consisting of India-rubber, with other ingredients ordinarily known amongst dentists as vulcanite or the vul-

canite base. This substance after being compressed in a mould formed from an impression taken in wax or gutta-percha of the inside of the mouth, so as exactly to fit the roof or other part of the mouth, is baked or hardened by heat in the mould. When taken out of the mould, the surface being ordinarily dark colored and more or less rough, is not only unpleasing in appearance, but would be disagreeable in the mouth. Dentists, therefore, usually file or scour off the rough outer surface, and refit it as exactly as possible to the convolutions of the palate or other part of the mouth by cutting or otherwise. After the piece has been so reduced, the fit is necessarily imperfect. Vulcanite has an odor of which it has hitherto been impossible wholly to get rid, notwithstanding the most careful preparation of the material.

My invention consists in protecting the surface of the vulcanite by a thin coating of gold, platina, or tinfoil, and for that purpose lining the mould, when prepared for the reception of the vulcanite, with gold leaf, gold foil, or crystal gold, platina leaf, or tinfoil, by which the surface of the vulcanite mouth-piece is preserved from injury or discoloration in the process of hardening. By this means an exact fit accurately corresponding to the original wax impression of the mouth is preserved. The metallic surface may be thickened by electroplating them in the gold, if it be thought desirable. The heat and compression in the process of hardening the vulcanite causes the vulcanite to adhere strongly
739 to the metallic surface, so that the metal forms an external surface, which not only protects the mouth-piece from injury when in use, but prevents the escape of objectionable odors.

Specification in pursuance of the conditions of the letters patent, filed by the said Matthew Cartwright in the Great Seal Patent-Office on the 24th December, 1860.

To all to whom these presents shall come, I, Matthew Cartwright, of No. 7, the Crescent, Carlisle, dentist, send greeting:

Whereas Her most Excellent Majesty Queen Victoria, by her letters patent, bearing date the twenty-sixth day of June, in the year of our Lord one thousand eight hundred and sixty, in the twenty-fourth year of her reign, did, for herself, her heirs, and successors, give and grant unto me, the said Matthew Cartwright, her special license that I, the said Matthew Cartwright, my executors, administrators, and assigns, or such others as I, the said Matthew Cartwright, my executors, administrators, and assigns, should at any time agree with and no others, from time to time and at all times thereafter during the term therein expressed, sholud and lawfully might make, use, exercise, and vend within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an invention for "improvements in the manufacture of mouth-pieces for dental and other purposes," upon the condition (amongst others) that I, the said Matthew Cartwright, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent-Office within six calendar months next and immediately after the date of the said letters patent:

Now, know ye that I, the said Matthew Cartwright, do hereby declare the nature of my said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, that is to say:

At the present time the mouth-pieces used by dentists for the insertion of artificial teeth and other similar purposes are commonly formed of a composition ordinarily called or known amongst dentists as vulcanite or the vulcanite base, being a kind of hardened india-rubber, or rather a composition formed of india-rubber, with other ingredients. This substance is first moulded to the shape of the mouth, which is usually done by compressing it in a mould formed from an impression taken in wax or gutta-percha of the inside of the mouth, so as exactly
740 to fit the roof or other part of the mouth to which the mouth-piece is to be adapted. It is then baked or hardened by heat in the mould. When taken out of the mould the surface of the vulcanite mouth-piece is generally dark colored, and more or less rough; such dark color and roughness being caused by the heat or immediate contact with the mould. It is therefore not only unpleasing in appearance, but would be disagreeable in the mouth. Dentists, therefore, usually file or scour off the rough outer surface, and then polish the piece, refitting it as accurately as possible to the convolutions of the palate or other part of the mouth. The reduction, however, necessarily renders the fit imperfect, and the colour and smell of the composition are unpleasant.

The present mode of manufacturing such vulcanite mouth-pieces for artificial teeth is as follows: An impression of the inside of the mouth is taken in wax or gutta-percha; from that a plaster of Paris cast is taken. In the crescent of the model or cast so made, the artificial teeth are placed in the position which they are intended to occupy in the mouth of the patient, and fixed in that position with wax. A mouth-piece is then formed upon the model with heated wax, and attached to the teeth. The model containing the teeth and wax mouth-piece is then placed in the lower half of a metallic flask, and plaster is poured round it to fix it. It is then allowed to dry. When dry the surface of the plaster contained in the lower half-flask is rubbed over with oil, soap lather, or some liquid which will prevent the plaster in the upper half-flask from adhering to it. The upper half-flask is then placed upon the lower half, and the upper half is then filled up with liquid plaster; the lid of the upper half-flask is put on, and the whole is then allowed to stand till dry, which will be in about an hour. When dry the upper and lower half-flasks are separated, but the lid is not taken off. When separated the wax is taken out, leaving the teeth fixed in the plaster; the two half-flasks being still separated, are then placed in a digester or heating apparatus for the purpose of being heated till thoroughly warm. A piece of the composition called vulcanite or vulcanite base is then cut in pieces and softened by heat on a hot plate or otherwise, and the cavity for the mouth-piece well filled or packed therewith. Both half-flasks are then replaced in the digester till the vulcanite is sufficiently softened by the heat, when they are taken out of the digester. The two halves of the flask are then put together and placed in a vice or under a press, so as to compress the vulcanite, and bring the edges of the mould into close contact. They are allowed to remain in the vice or press till they are partially cooled and the vulcanite is set.

Some dentists adopt another mode of filling the cavity of the mould with vulcanite after melting out the wax by heat, through a small hole left in the plaster for that purpose, without separating the parts of the flask. They force the vulcanite, which has been previously
741 softened in a heated cylinder, by means of a screw worked by hand into the mould through the nozzle of a pipe attached to and forming part of the cylinder, which is inserted in a hole in the

lid of the flask. The vulcanite being so pressed in by the screw does not require to be compressed by means of the vice or press. In other respects the process is similar to that before described.

The flask, when filled by either of the methods aforesaid, is then placed and screwed in a clamp in order to keep it together. The vulcanite is then baked or hardened by placing the whole in a heating apparatus. After being baked for about two hours, it is taken out and allowed to cool. When cool the flask is separated, and the mouth-piece to which the teeth are attached is taken out of it. The surplus of the vulcanite is then cut away, and the rough overplus filed or cut off; the piece is then scoured and polished up for the use of the patient.

My invention consists in protecting the surface of the vulcanite by a coating of gold, platina, or tin foil, and for that purpose lining the mould when prepared for the reception of the vulcanite with gold leaf, gold foil, or crystal gold, platina leaf, or tin foil, by which the surface of the vulcanite is preserved from injury or discoloration in the process of hardening, or otherwise. By this means an exact fit accurately corresponding to the original wax impression of the mouth is preserved. The compression and heat employed in the process of forming and hardening the mouth-piece cause the vulcanite to adhere strongly to the metal, so that the metal forms an external surface, which protects the mouth-piece from injury when in use. The metallic surface may be thickened by electroplating if thought desirable.

On obtaining the plaster mould, fixing the teeth, and forming the wax mouth-piece, I proceed in the mode usually adopted and hereinbefore described. The wax used should be free from Canada balsam, which is found in some wax used for dental purposes. The wax mouth-piece, when cool, is taken out of the model with the teeth attached thereto, and the model lined with crystal gold, gold leaf, platina, or tin foil, which must be carefully pressed into the crevices, hollows, and irregularities formed by the convolutions of the mouth and other parts of the mould. Should any crack in the gold leaf occur in the course of adaptation, the interstice should be carefully covered with additional gold leaf, crystal gold, platina, or tin foil, by pressing and fitting the same thereto. I prefer what is known as crinkled gold leaf for the side of the mouth-piece next the palate, or which is to rest against the jaw; and for the palate of the mouth-piece, or that part thereof which is to be in contact with the tongue, I prefer gold leaf rough on one side, viz, that in contact with the vulcanite, and smooth on the other, i. e., that which is to be in contact with the tongue. The wax mouth-piece is then replaced on the model, and the upper side of the wax piece is then covered with
742 crystal gold, gold leaf, platina, or tin foil, by fitting and pressing the same thereto and thereon. A small rod of wax is then formed sufficiently long to reach to a hole in the lid of the flask when stuck on in an upright position on the wax mouth-piece. The wax rod should be about the thickness of a large pencil. A hole exactly the size of the rod should be then cut in the wax mouth-piece through the gold covering with a knife or other sharp instrument, and the rod united to the wax mouth-piece. Two smaller rods, each about the size of a crow-quill, are then formed in wax, and in like manner attached to the mouth-piece on each side of the same. The upper half-flask is then put on. Next, the ends of the two rods are connected with two holes, one on each side of the upper half-flask, called the escape gates. The upper half-flask is then filled up with liquid plaster, and the lid put on, and the whole allowed to stand till the plaster is set. When the plaster is set the whole flask is put into a clamp, and placed in a saucepan of boiling

water with the lid of the flask downwards, so that the wax may run out freely, care being taken that the lid of the flask does not touch the bottom of the saucepan. When the wax is boiled out the flask may be taken out of the saucepan and placed in a saucepan containing clean boiling water, with about a half an ounce of washing soda in the water, so as to extract any greasy matter. Boil it for five minutes, and then take out the flask and place it in a digester until it becomes thoroughly heated to boiling heat, so that it may be fit for the reception of the vulcanite. The flask is then to be taken out of the saucepan, removed from that clamp, and screwed in a strong powerful clamp, so that the flask may be firmly held together; the flask should then be placed in a vice, or otherwise firmly fixed, as by a powerful screw opposite to the nozzle of a cylinder, in which the vulcanite is heated, care being taken to place the nozzle well into the hole of the lid. The vulcanite, which may be softened in the cylinder by means of steam, is then driven by means of a piston attached to a screw, worked by the hand through the nozzle of the cylinder into the flask, until the vulcanite comes out of the escape gates. The operator should then pause for a minute, and then again proceed to force, by means of the screw, more vulcanite into the flask, which will be found capable of receiving it without any equivalent quantity exuding from the escape gates. When the flask will not receive any more, the surplus vulcanite should be pinched off at the escape gates, and two small screws made to fit such escape gates screwed in. The operator should again proceed to force in as much more vulcanite by the cylinder or piston screw as the cavity will admit, so that the vulcanite may be firmly compressed into the mould. The flask is then allowed to remain a few minutes to cool, so that the vulcanite may get partially set in the cavity. The flask is then to be removed from the nozzle of the cylinder, and a metal nut or
743 stopper placed to fill up the hole in the lid. The flask is then removed from the clamp and screwed into a bridle clamp, which is brought over the nut or stopper. The vulcanite is then hardened by placing the flask with its contents on an ordinary steam or dry heat vulcanizer, and keeping up the heat at a temperature of three hundred and fifteen degrees for about two hours. After the flask is taken out of the vulcanizer it is allowed to cool, and the clamp may then be removed, and the parts separated in the usual way. The vulcanite ends communicating with the escape gates and hole in the lid must next be cut off even with the surface of the mouth-piece, and at these spots not covered with gold, holes may be drilled, so as to form small cavities, which may be filled with fresh vulcanite, or Jacob's gutta-percha; if the former, the mouth-piece must again be placed upon the model and put in the digester, and the vulcanite while in a hot state covered with crystal gold. If the latter be used, it may be melted into the cavities by means of a hot iron, and the surface covered with crystal gold.

Another and more simple mode of covering the mouth-piece with the gold leaf, crystal gold, platina, or tin-foil, is as follows: After having formed the wax mouth-piece and teeth upon the model, the same is placed in the lower half-flask, and fixed therein with liquid plaster. The gold leaf, crystal gold, platina, or tin foil is then nicely adapted upon and over the upper side of the wax mouth-piece, and after soaping or oiling the plaster in the lower half-flask the upper half-flask may be placed upon the lower half, and the flask filled up with plaster; the lid may then be put on, and the whole allowed to stand till the plaster is set. After the plaster is set the parts of the flask should be separated, when the wax mouth-piece and teeth will be found firmly imbedded in

the upper half-flask, which may be placed in a saucepan of boiling water to boil out the wax, in the manner before stated. The model, which is now in the lower half-flask, is now to be put into a digester and heated for about half an hour, when it may be taken out, and the gold or other leaf carefully adapted upon it in the manner above described, then take the vulcanite and heat it in the cylinder, as above described. When the vulcanite is sufficiently soft it may be worked out of the nozzle into the hand, and the cavity of the plaster cast in the upper half-flask filled with the vulcanite by the hand, carefully adapting it with the fingers. This should be quickly done while the vulcanite is soft and hot. A sufficient quantity should be put in to leave a slight overplus when the flask is put into the press. Both half-flasks are then to be put into the digester and well heated to about boiling heat. The two half-flasks may then be taken out, put together, and placed in a screw press, where they may remain for ten minutes; they may then be taken out and put into a clamp, after which the mouth-
piece must be baked or hardened by heat of a temperature of
744 three hundred and fifteen degrees, as above described. By this process the edges may not be completely covered by the gold, owing to the surplus vulcanite, which, when pressed, comes out between the two half-flasks. I have found the vulcanite rubbers which are not highly colored the best adapted for the purposes of this invention.

What I claim as my invention is, the protecting the surface of the vulcanite by a coating of gold, platina, or tin-foil, in the manner and for the purposes described, and the lining the mould when prepared for the reception of the vulcanite with gold leaf, gold foil, or crystal gold, platina leaf, or tin-foil, by which the surface of the vulcanite may be preserved from injury or discoloration in the process of hardening, and an exact fit accurately corresponding to the original wax impression of the mouth be preserved.

In witness whereof I, the said Matthew Cartwright, have hereunto set my hand and seal the twenty-second day of December, in the year of our Lord one thousand eight hundred and sixty.

MATTHEW CARTWRIGHT. [L. S.]

We hereby certify the above to be a true copy.

SAMUEL CASSERLY,
H. A. CHEESWRIGHT,
Clerks in the Patent Office.

745 The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office of the drawing in the matter of the application of Robert Haering, filed March 25th, 1856, for "Artificial Teeth."

In testimony whereof I, J. M. Thatcher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this seventeenth day of May, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

[L. S.] J. M. THACHER,
Acting Commissioner.

746 The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this

office of the file-wrapper and contents in the matter of the application of Robert Haering, filed March 25th, 1856, for "Artificial Teeth."

In testimony whereof I, M. D. Leggett, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this fourth day of August, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-eighth.

[L. S.]

M. D. LEGGETT,
Commissioner.

STATE OF NEW YORK,
City and County of New York, ss :

On this 10th day of March A. D. 1856, before the subscriber, a commissioner of deeds, personally appeared the within-named Robert Haering, and made solemn oath that he verily believes himself to be the original and first inventor of the mode herein described for inserting artificial teeth by the introduction of vulcanized hard India rubber, and that he does not know or believe the same was ever before known or used, and that he is a citizen of the United States.

L. PITKIN,
Commissioner of Deeds.

$30, gold. 2 dr. Model. Hand.

NEW YORK, *March 6th*, 1856.

To the COMMISSIONER OF PATENTS,
Washington, D. C. :

The petition of Robert Haering, of the city and county of New York and State of New York, respectfully represents—

That your petitioner has invented a new and improved mode of inserting artificial teeth, which he verily believes has not been known prior to the invention thereof by your petitioner.

He therefore prays that letters patent of the United States may be granted to him, therefore vesting in him and his legal representatives the exclusive right to the same, upon the terms and conditions
747 expressed in the act of Congress in that case made and provided; your petitioner having paid thirty dollars into the treasury, and complied with other provisions of the said act.

ROBERT HAERING.

If patent issues or any correspondence will be addressed to Mr. Haering, care Dr. J. B. Wheat, dentist, Philadelphia, Pa.

Assignment rec'd.

NEW YORK, *March 6th*, 1856.

To all whom it may concern :

Be it known that I, Robert Haering, of the city and county of New York and State of New York, have invented a new and improved mode of inserting artificial teeth, and I do hereby declare that the following is a full and exact description, to wit :

The nature of my invention consists in the introduction and application of vulcanized hard India rubber in constructing the base to artificial teeth, viz, artificial sets of teeth. To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation, reference being had to the annexed drawings making a part of this specification, in which Fig. 1 is a perspective view

of a cast of the mouth in plaster; Fig. 2, teeth on a wax base fitted to the plaster cast as they should be arranged for the mouth; Fig. 3 represents the teeth on the wax imbedded in plaster to hold them in place when the wax is removed. When this plaster is set I cover the whole with plaster as represented by Fig. 4. When sufficiently hard the mole is separated and the wax exchanged for the preparation of rubber, when the parts of the mole are replaced. This is placed in a steam oven and subjected to a heat of 280 to 300 degrees for the space of six to eight hours' time. When taken out all is finished, and the teeth will be found to be beautifully set in hard rubber, a material possessing advantages over anything in use.

What I claim as my invention and desire to secure by letters patent is the application of vulcanized hard India rubber as a new material, and a new mode for constructing a base to artificial teeth (viz, artificial sets of teeth).

ROBERT HAERING.

Witnesses:
L. PITKIN.
WM. DIXEY.

Cancelled 12th August, 1856.

748 PHILADELPHIA, *April 5th*, 1856.

Hon. Judge MASON,
Commissioner:

DEAR SIR: The enclosed has been delayed in consequence of a letter to Mr. H. not reaching him.

As the patent is in Mr. Haering's name, and he wishes me to attend to all this business for him, a power of attorney is necessary, and I therefore forward it, regretting that it has been delayed so long.

I shall feel under great obligations to you if you will interest yourself in this case, so as there shall be no unnecessary delay in the granting of letters patent.

Hoping that you are well, I have the honor to be,
Your obedient servant,

J. B. WHEAT,
Dentist, 433 *Walnut Street.*

Power of attorney.

Know all men by these presents that I, Robert Haering, of the city, county, and State of New York, have made, constituted, and appointed, and by these presents do make, constitute, and appoint Jerome B. Wheat, of Philadelphia, Pa., my true and lawful attorney for me and in my name, place, and stead, and as my agent to receive and conduct all correspondence which may be necessary in relation to a certain application for a patent for using "hard India rubber for the teeth instead of gold," and to receive the letters patent which may be granted for said invention, and to receive any and all returnable money from the Commissioner of Patents at Washington, D. C., giving and granting unto my said attorney full power and authority to do and perform all and every act and thing whatsoever requisite and necessary to be done in and about the premises as fully, to all intents and purposes, as I might or could do if personally present, with full power of substitution and revocation, hereby ratifying and confirming all that my said attorney or his substitute shall lawfully do or cause to be done by virtue hereof.

In witness whereof I have hereunto set my hand and seal the 4th day of April, in the year one thousand eight hundred and fifty.

ROBERT HAERING. [L. S.]

Sealed and delivered in the presence of—
WM. DIXEY.

STATE OF NEW YORK,
City and County of New York, ss:

Be it known that on the fourth day of April, one thousand eight hundred and fifty-six, before me, Licius Pitkin, a notary public in
749 and for the State of New York, duly commissioned and sworn, dwelling in the city of New York, personally came Robert Haering, to me known, and acknowledged the above letter of attorney to be his free act and deed.

In testimony whereof I have hereunto subscribed my name and affixed my seal of office the day and year last above written.

[L. S.] L. PITKIN,
Notary Public.

3566.

APRIL, 1856.

The specification and claim of your application for base for artificial palates and gums have been examined.

You are referred to the article "Gutta percha as a base for artificial teeth" in the American Journal of Dental Science, series 2, vol. 2, page 332; to Delabarre's artificial palates and gums described in Dingler's Polytechnic Journal, vol. 122, page 239, wherein you will find your device anticipated.

On these references an application of John A. Cummings for patent for artificial palates and gums prepard of hard vulcanized India rubber has been rejected May 19th, 1855, and the rejection confirmed by a board of examiners on February 6th, 1856.

Your claim can therefore not be admitted.

ROBERT HAERING,
Care of Dr. J. B. WHEAT,
Dentist, Philadelphia, Pa.

3566–3.

APRIL, 1856.

Your argument against the rejection of your application for patent for artificial teeth is received, and will be duly considered upon your renewing your oath or abandoning your right of withdrawal, agreeable to the enclosed rules. The specification is returned.

As to your plea of a mistake or oversight on the side of the office, your attention is called to the fact that you overlook and do not notice at all the reference given you to Delabarre's artificial palate.

ROBERT HAERING,
Care of Dr. J. B. WHEAT,
Dentist, Philadelphia, Pa.

PHILADELPHIA, *April 21st*, 1856.

Hon. Judge MASON,
Commissioner of Patents, Washington, D. C.:

DEAR SIR: A letter from Mr. Shugert informs me that Haering's

claim cannot be admitted, and refers me to the articles on gutta-
750 percha, from which references they have rejected John A. Cummings's application for the same claim.

First permit me to inform you of the nature of Mr. Cummings's movements. He was informed by a workman in the shop with Mr. Haering of what was going on in reference to Mr. Haering being about to get up teeth in this way. Mr. Haering, not mistrusting anything wrong, got them up a set, and assisted the workman in getting up a number of sets at various times until he heard what Mr. Cummings's design was, after which he refused to show or assist them any more. This was after Mr. H. had been experimenting a long time, for he has been some years moving in this thing. Now, this is all Mr. Cummings knows about this discovery, and he has shown himself anything but a man in the course he has taken. It was told Mr. H. that he had taken out a caveat, but I could not believe it.

Mr. Haering commenced in this before Goodyear left this country for Europe. He was then in his employ, and has been until within the last year. He told Mr. Goodyear what he could do, and Mr. G. referred him to me if he required assistance. He is the bone fide discoverer of this valuable mode of inserting teeth, and with my assistance I believe it is brought to perfection.

I am not a little surprised that in your office it is seen to come under the head of gutta-percha, which it no more resembles in any particular than the pen I now use resembles the paper I write upon. Nor does the specification show that any of the process of preparing the rubber resembles that by which the preparation of gutta-percha is done. The gutta-percha is simply warmed with hot water, and it requires but a heat of from 110° to 150° to soften it. In this way they shape as they wish it. It is very elastic, and has to be supported by a frame-work which holds the teeth also. It has been tryed by dentists in all parts of the country, and, so far as I am acquainted, it is considered worse than the greatest of humbugs. It is only the inexperienced who have used it, for it shows for itself to those who are familiar with the principles which govern things. It is not fit to put in any mouth, nor will it keep its form. Then it has to be four times as thick (on the roof of the mouth) as any other substance. Hot drinks displace it. This is the nature of gutta-percha. It has no resemblance to India rubber in its crude state, nor are its chemical or mechanical properties the same.

India rubber in its crude state when exposed to the action of hot water does not lose its elastic properties and cannot be moulded. But though these gutta-percha preparations are all from the article in a crude state, this is not the case with our hard rubber, which you will observe by reference to the specification is secured in the plaster form,
and subjected to a heat of 300 degrees for seven or eight hours'
751 time in a steam oven. It is by this process that it is changed to the state of a hard and firm substance, and as the teeth are firmly imbed'ed in this they are stronger by far than by any other mode. No metal frame-work is required as in the gutta-percha, and it is impos'able for it to be in the slightest degree affected by any heat taken into the mouth.

It has been about eight years since Truman, in London, introduced the gutta-percha. It has had its run; but it has run among fools only. The first case I saw my only thoughts were then, How could it be pos'able for a dentist or one who is fit to be called one to think of using such a substance? Still, plenty have tried it, but only to abandon it in disgust.

I do not know as you will consider that there is any neglect in reference to this case, but it appears to me that if you ever had a case free from all and every infringements on others' rights, this is one; that if there ever was a useful claim, this is one; while I have shown that the other is a most valueless one, and from a foreign land.

What, then, is the position in which you place us? If the gutta-percha trash of England moves this way, with his patent granted at our capital, we are at *once* subjected to an injunction. No matter how palpably absurd the principle, he is first, and that which is known to be one of the most valuable discoveries of the age must be thrown to the winds to give place to a thing which is worse than nothing. More, the bold, industrious American citizen, who has toiled for years and at last discovered what he knows is for the happiness of his fellow-citizens, and, withal*l*, to support himself and family from degradation and want, must suddenly open his eyes—to what? I want only what I have a right to ask*e*. Give us this, and let the worthless pass.

I take the liberty to enclose in this letter one of my advertisements, with the view to show you my confidence in the article, as well as to enable you to see that this invention possesses advantages of the highest kind over all other modes. And I state nothing but what I can sustain. And now I will end this long and hastily-written letter. Hoping that I have said nothing but what will be received as intended, in the most friendly sense, and with the highest regards to your happiness and prosperity,

I am, truly and respectfully, yours,

J. B. WHEAT.

Hon. Judge MASON, *Commissioner.*

P. S.—The above is written with the view of calling the attention of the office to what appears to be a mistake or oversight in reference to this matter, and not with any desire or intention of forfeiting the right of withdrawal.

Yours,

J. B. WHEAT.

752 THE GREAT DISCOVERY IN DENTAL SCIENCE. ARTIFICIAL TEETH FREE FROM THE COMMON OBJECTIONS.

The only material appropriate for a base to artificial sets of teeth is the vulcanized hard rubber, as introduced by J. B. Wheat. It is free from the following objectionable features which exist in teeth inserted on gold plate, namely: great weight, imperfect fitting of the plate to the mouth, metallic taste, and want of cleanliness and strength where the teeth unite with the metal. No force in masticating can injure them.

J. B. WHEAT,
433 *Walnut street, little west of Broad, Philadelphia.*

N. B.—This is an entirely different article from the gutta-percha, which is found so defective.

PHILADELPHIA, *May 13th*, 1856.

Hon. Judge MASON, *Commissioner:*

DEAR SIR: Having been absent from the city, have but just received yours of April 30th.

I found the journal referred to in the Astor Library, New York City.

The article is in German. The writer, after speaking of the preparation as being composed of gutta-percha, combined with some of the porceline clays, describes its qualities and shows it to be entirely unfit for filling or inserting teeth. According to the description, it is far inferior to the article referred to in my former letter. We pronounces it worthless.

It is very, very evident that I am very blind on this subject, for I am unable to see the slightest basing in these references to our hard rubber invention, which we present.

There is no similarity in the mode of making the two articles, nor can there be, the article of the gutta-percha requiring a different process entirely from that which we take to produce the hard rubber in this form. While the one is proved to be a valuable article, the other is and must ever be entirely worthless.

I know that we are in possession of an original and most valuable principle, but what the difficulty is to our securing it by letters patent I am at a loss to understand, and must again avail myself of the privilege given in your circular, and ask if there is not a mistake or oversight on the part of the office in reference to this claim.

If it is otherwise, and you still adhere to the necessity of my submitting to a second examination, I must withdraw this application.

Truly and respectfully, yours,

J. B. WHEAT.

753 P. S.—Mr. Haering is a party with Mr. Goodyear in a patent right for using the plaster forms as used in the process and as described in the specification.—J. B. W.

3566–5.

MAY, 1856.

Yours of the 13th instant, against the rejection of your application for patent for artificial teeth, is received and will be answered you as soon as, agreeable to the rules, you return the specification sent you on the 24th instant, and renew your oath.

ROBERT HAERING,
Care of Dr. J. B. WHEAT, *Dentist, Phila elphia, Pa.*

PHILADELPHIA, *May 21st*, 1856.

Hon. Judge MASON, *Commissioner*:

HONORED SIR: The two references given on which Haering's claim is rejected relate to preparations of gutta-percha—not hard rubber. They are not chemically the same, nor can the same process prepare one which is required to prepare the other. There is nothing in the two which resemble in any particular the other. The gutta-percha preparation, from the nature of the article, softens when exposed to the hot liquids which pass through the mouth, under the same principle that it is softened when moulded for the same, and can never be a fit substance to enter the human mouth in consequence, if it had no other objections, which it has, quite as important as this, but it is not requisite to name them.

Our specification represented the process required to produce the hard rubber, which is quite a different thing from softening a preparation of any substance in hot water and molding it to a form.

We have not been able to see any analogy between that which is presented in one claim and the references. In consequence, I have used

the privilege given for pointing out what I believe to be an "oversight or neglect on the part of the office."

All my communications to you rest on this point, which, if seen on the part of your office, you promise chearfully to correct. It is just that this is settled before I decide on submitting it to a second examination.

If you wish fa'ther evidence, I can send you some of the preparation of gutta-percha, such as is said to be the best article compounded, and which is used by a "greenhorn" occasionally.

By placing the two in hot water you will require no fa'ther evidence, for the one will re'dily soften, while the other will not be effected.

754 It is on sale at the dental establishment of Jones, White & McCurdy, Arch street, in this city.

I am, dear sir, very truly, yours,

J. B. WHEAT.

3566-7.

MAY, 1856.

In reference to yours of the 21st instant, you are simply invited to better examine the references given you on the 18th ult., especially the case of John A. Cummings, rejected May 19th, 1855. You will see then, plainly, that the privilege you claim does not apply to your case. The requisition of the instant is therefore adhered to.

ROBERT HAERING,
Care of Dr. J. B. WHEAT, *Dentist, Philadelphia, Pa.*

NEW HAVEN, *July 5th,* 1856.

Hon. Judge MASON, *Commissioner of Patents:*

HONORED SIR: Mr. Haering will alter his claim, and ask in favor of his process of a new mode of uniting porcelain teeth to vulcanized hard rubber, and describing the form of the teeth necessary to be used by this mode of inserting.

Is he entitled to make this alteratio n in his papers?

Yours, very respectfully,

J. B. WHEAT.

3566-9.

JULY, 18 6.

In answer to yours of the 5th instant, in reference to your rejected application for a patent for artificial teeth, you are referred to section 38 of the enclosed rules.

ROBERT HAERING,
Care of Dr. J. B. WHEAT, *Dentist, Philadelphia, Pa.*

NEW HAVEN, CONN., *Aug. 9th,* 18 6.

Hon. Judge MASON, *Commissioner of Patents:*

SIR: Mr. Haering has made his claim less broad, and altered his specification by writing it out anew, also adding two more drawings, to make it more full and comprehensive.

755 Supposing that this change in the papers will prevent the necessity of any evidence on the Cummings reference, etc., anything

further in respect to the gutta-percha case, I have deferred anything on those points.

Hoping that these papers are right in all respects with your rules, I am, very respectfully, yours,

J. B. WHEAT.

P. S.—I shall be in N. H. until October, and wish you to have the kindness to direct all papers to me here up to that time.

J. B. WHEAT,
New Haven, Conn.

STATE OF NEW YORK,
City and County of New York, ss:

On this seventh day of August, A. D. 1856, before the subscriber, a commissioner of deeds, personally appeared the within-named Robert Haering and made solemn oath that he verily believes himself to be the original and first inventor of the mode herein described for inserting artificial teeth by the introduction of vulcanized hard India-rubber, and that he does not know or believe the same was ever before known or used, and that he is a citizen of the United States.

L. PITKIN,
Com'r of Deeds.

I hereby amend my specification by writing out the entire paper anew.

NEW YORK, *March 6th*, 1856.

To all whom it may concern:

Be it known that I, Robert Haering, of the city of New York, in the county of New York and State of New York, have invented a new and improved mode of inserting artificial teeth, and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings and to letters of reference marked thereon.

The nature of my invention consists in a new mode of uniting porcelain teeth to vulcanized hard India rubber, which forms mouth-plates, or what is termed the base, to whole or partial sets of teeth.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

I make the teeth in the usual manner, with the exception of their form, which is to gro've the sides and ends, sometimes adding a cavity to the sides extending a little deeper than the gro've, without passing entirely through the tooth.

756 Fig. 1, the accompanying drawing, is a perspective view of a plaster cast of the upper jaw.

Fig. 2, the same cast with a set of teeth set in wax resting upon it.

The fronts of this set of teeth we now imbed in plaster, as represented in Fig. 3. This plaster to support the teeth forms the section of the mole, as seen in Fig. 4.

I now cover all this (as seen in Fig. 3) in a bedding of plaster one inch in depth, as represented by Fig. 5. Pins of small wire are run through the mole to hold the parts in place. This mole is now taken apart and the top section is represents in Fig. 6.

The wax that the teeth are set in is now changed for the compound which is to form the rubber base, and the parts of the mole put in their place, closed tight, and placed in a steam heater and subjected to from 6 to 8 hours' heat, of from 280° to 300°. When taken out the process is compleated.

What I claim as my invention and desire to secure by letters patent is the process of a new mode of uniting porcelain teeth to vulcanized hard India-rubber, as within described.

ROBERT HAERING.

Witnesses:
L. PITKIN,
WM. DIXEY.

3566—11.

AUGUST, 1856.

Yours of the 9th inst., with reference to your rejected application for letters patent for artificial teeth, is received.

Your amended specification cannot be considered as such consistently with the thirty-eighth and twenty-sixth section of the rules sent you on the 8th ult. That your specification is amended in material parts is evident, on the simple fact that you found it necessary yourself to file additional drawings. Your model does not show the formation of teeth you now describe, and this alleged improvement has nothing to do with the material of the base; your amendments falling thus within the scope of amendments inadmissible under the rules. You are still at liberty to withdraw your original application, or to insist upon its re-examination, with or without—with proper amendments or without. Your new claim, however, cannot be examined but under a new fee upon a new application.

ROBERT HAERING,
Care J. B. WHEAT,
Dentist, Philad'a, Pa.

756 *a* and *b*, diagrams, follow.

757

NEW HAVEN, CONN.,
Sept. 10th, 1856.

Hon. Judge MASON, *Com'r:*

SIR: Some weeks since I forwarded to you Mr. Haering's specification amended, together with the original papers. In doing this I adhered to the rules laid down in your circular as I understood them. Mr. H. is anxious to sell his invention, which he cannot do until the patent is had, and as he is a person of no means, it is of consequence to him to know what he can expect. If, therefore, you would interest yourself in this case so as to have it brought to an early close, I shall feel that you have conferred a great favor, and shall hold it in grateful remembrance.

Very respectfully, yours,

J. B. WHEAT.

P. S.—You will notice that it is only on this process that he feels any interest. All else he will forego.—J. B. W.

3566—13.

SEPTEMBER, 1856.

In answer to yours of the 10th inst., with reference to your rejected application for patent for artificial teeth, you are referred to the official letter of the 14th ult., directed to you, care of Dr. J. B. Wheat, Philadelphia, Pa.

ROBERT HAERING,
Care of Dr. J. B. WHEAT, *Philad'a, Pa.*

To the COMMISSIONER OF PATENTS:

SIR: I hereby withdraw my application for a patent for artificial teeth, now in your office, and request that twenty dollars may be refunded to me, agreeably to an act of Congress in such cases made and provided.

J. B. WHEAT,
Att'y for R. Haering.

WASHINGTON, *April 29th*, 1857.

PATENT OFFICE, , 185 .

Please date, sign, and return the above receipt and withdrawal, when twenty dollars will be refunded to you. As the money can be paid only in specie, you are requested to state distinctly whether it shall be remitted in gold by mail, or paid to your order at this office. It can be refunded only in one of these two methods.

Commissioner of Patents.

758 No. . 3566. Gale.

Robert Haering, of New York, county of , State of New York.—Artificial teeth.—Oath renewed.

Rec'd March 25th, 1856.
Petition " " "
Affidavit " " "
Specification " " "
2 drawings " " "
Model " " "
Cert. dep.
1 Cash $30, " " 1856.
Examined, } Cash to attorney April 29th, 1857.
2 Issue, }
4 Patented , 185 .
Recorded, vol. , page .
Care Dr. J. B. Wheat, dentist, Philad'a, Pa.
D.

	Report to examiner	April 17th, 1856.
1	Rejected	" 18th, "
2, 3	Specification to application	" 24th, "
4, 5	Letter	May 16th, "
6, 7	"	" 26th, "
8, 9	Letter with rules	July 8th, "
10, 11	Letter	Aug. 14th, "
12, 13	"	Sept. 13th, "

759 The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office of the file wrapper and contents in the matter of the letters patent granted John B. Newbrough, assignee of Robert Haering, dated January 19th, 1869, No. 85927, for "Improved mode of mounting artificial teeth."

In testimony whereof I, M. D. Leggett, Commissioner of Patents, have

caused the seal of the Patent Office to be hereunto affixed this twenty-eighth day of July, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-eighth.

[L. S.]

M. D. LEGGETT,
Commissioner.

WASHINGTON, D. C., *Oct. 28th*, 1868.

To the honorable COMMISSIONER OF PATENTS:

SIR: I hereby inclose specification relating to R. Haering's improvement in "mounting" artificial teeth, with fifteen dollars as first fee.

It is requested that the specimens filed March 25th, 1856, may be applied in this case.

Very respectfully, yours,

H. HOWSON,
Att'y for R. Haering.

To the COMMISSIONER OF PATENTS:

The petition of Robert Haering, of Melrose, West Chester County, New York (now residing in Montreal, Canada), respectfully represents, that your petitioner has invented a new mode of mounting artificial teeth, which he verily believes has not been known or used prior to the invention thereof by your petitioner; he therefore prays that letters patent of the United States may be granted to him therefor, vesting in him and his legal representatives the exclusive right to the same upon the terms and conditions expressed in the act of Congress in that case made and provided; he having paid fifteen dollars into the Treasury, and complied with the other provisions of the said act.

And he hereby constitutes and appoints Henry Howson, of the cities of Philadelphia and Washington (or his duly authorized agent), his lawful attorney, with power to alter and modify the specification,
760 to sign the drawings, to alter the same, to substitute other specifications and drawings as he may deem expedient, to do all other acts necessary in prosecuting this application, and to receive and transmit the patent when granted.

Signed at New York, this sixteenth day of October, 1868.

ROBERT HAERING.

[Stamp.]

To all whom it may concern:

Be it known that I, Robert Haering, of Melrose, West Chester County, New York, now residing in Montreal, Canada, have invented an improvement in mounting artificial teeth, and I do hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to an improvement in securing artificial teeth upon bases, or plates, of hard or vulcanized rubber, or other gum.

In order to enable others skilled in the art to practice my invention, I will now proceed to describe the manner of carrying it into effect:

A plaster cast of the mouth to which the teeth are to be fitted is first made. A coating of wax corresponding in shape and thickness to the "base" required is then applied to the cast and round the bases of the teeth, which are thus held in their proper position.

The teeth and base are now covered with plaster, which is applied in a soft state, but soon hardens, forming the second division of a mould, the other part of which is the cast first made. After the portion of the

mould last made has hardened, the two divisions are separated, the wax is removed, and prepared rubber is substituted for the same, the sections of the mould being brought together so as to force the gum into all the interstices formerly occupied by the wax.

The mould is then placed in an oven and subjected to heat for such a length of time as may be necessary to harden the gum.

When the operation is complete the plaster is broken away, and the teeth will be found securely "set" or "mounted" on a base of gum which is hard, tough, corresponds in shape to the wax base first made, and possesses many advantages over bases made of ordinary material. Without here claiming broadly the application of hard rubber or gum, as a base for artificial teeth, I claim as my invention and desire to secure by letters patent artificial teeth having gum bases to which the teeth are secured as described—that is, by "setting" the teeth in prepared gum on a mould, imbedding the whole in plaster, and hardening the gum by the application of heat.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ROBERT HAERING.

Witnesses:
SAM. JOHN STORRS.
JOHN A. FOSTER.

761 STATE OF NEW YORK,
City and County of New York, ss:

On this sixteenth day of October, 1868, before me, the subscriber, a notary public in and for the city and county of New York, aforesaid, personally appeared the within-named R. Haering, and made solemn oath that he verily believes himself to be the original and first inventor of the mode of mounting artificial teeth herein described, and that he does not know or believe that the same was ever before known or used, and that he is a citizen of the United States.

[L. S.] SAM. JOHN STORRS,
Notary Public City and County of New York.

STATE OF NEW YORK,
City and County of New York, ss:

On this ninth day of December, A. D. 1868, before me, the subscriber, a notary public in and for the city and county and State aforesaid, personally appeared Robert Haering, who being duly sworn according to law, says:

I am the inventor of a mode of mounting artificial teeth, for which I filed an application for letters patent of the United States, on the 25th of March, 1856. The application was rejected and several times amended. I used my best endeavors to obtain a patent through my attorney, Jerome B. Wheat. The application was finally withdrawn, and the fee of twenty dollars returned, as I have learned. I was unacquainted with the practice of the office, and depended upon the advice of my attorney. Had I known that I might have obtained a patent by proceeding further in the case, I should have done so. It was never my intention to abandon the invention; I have always believed and frequently asserted that my invention should have been patented; and had I been aware at an earlier day that the office would reconsider the case, I would have taken such steps as my means permitted to have obtained an immediate reconsideration of the application. I believe that through my ignorance

of the practice of the office, and from being ill-advised, and I know that from no lack of appreciation of the invention or want of interest in it on my part, I have been deprived for years of the protection to which I was justly entitled, and have been helpless to prevent the public use of my invention.

ROBERT HAERING.

Subscribed and sworn to before me this 9th day of December, A. D. 1868.

[L S.] M. M. LIVINGSTON,
Notary Public, New York City.

762 WASHINGTON, D. C., *Jan. 5th*, 1869.

To the honorable COMMISSIONER OF PATENTS:

SIR: Above is my check for twenty dollars to be used as follows: Second government fee. J. B. Newbrough, assignee of Haering. Mounting artificial teeth, $20.00.

Very respectfully, yours,

H. HOWSON.

No. 85927. 1868. $\frac{11}{1}$

Robert Haering, of Melrose, county of West Chester, State of New York (now residing in Montreal, Canada), assignor to John B. Newbrough, of New York, N. Y.

Mode of mounting artificial teeth.

Rec'd	Oct. 29th, 1868.	
Petition	" " "	
Affidavit	" " "	
Specification	" " "	
Drawing / Model } specimens.	" " "	
Cert. dep.		
1 cash, $15.	" " "	
Add'l fee cert.		
1 " " cash $20.	Jan. 5th, 1869.	
Examined	T. J. Barnett.	
2 issue minute	Jan. 5th, 1869	
3 patented	" 19th, "	
Recorded, vol. , page		
Circular	Jan. 5th, 1869.	
H. Howson, pres't.		

763 [From the Lancet. Vol. II, Sept. 13th, 1845, pages 284 to 287: Vol. II, Sept. 20th, 1845, pages 310 to 312.]

Observations on Congenital Fissure of the Palate, with some remarks on Articulation and Impediment of Speech. By Charles W. Stearns, Esq., Surgeon, London.

* * * * * * *

The next experiment was made by taking a lamina of caoutchouc, having a smooth surface, and connecting it by means of a sort of frame work to the metallic arch or roof. But this, as may be imagined, proved a flimsy and perishable affair; for although it caused no irritation to the surrounding soft parts, yet its very want of firmness defeated its utility,

and its original shape was soon destroyed by the moisture, animal heat, and muscular action to which it was necessarily exposed. This suggested the plan of cementing together two lamina caoutchouc, between which small flattened elastic gold wires were first laid, and by bending these any required shape could be given to the velum, which, it was expected, it would retain. This last essay was attended by some rather encouraging results, as the closure of the fissure was rendered more complete than by any former method, while the material was sufficiently yielding to permit the free motion of the surrounding soft parts, and the character of the voice became, in some slight decree, improved. But this did not continue long, as the constant muscular impact had the effect, after a while, of bending the wires, and thus distorting the velum, and finally forcing apart the separate lamina of which it had been constructed.

Thus nature seemed determined to defeat and reject all our best endeavors to supply her occasional imperfections; for it must be understood that much time and labor were expended in the processes of fabrication before we could bring our various designs in the form contemplated, in order to admit of their utility even being tested. Just
764 at this stage, and as we were about to abandon, in despair, all further operations, we became acquainted with a new preparation of caoutchouc, the invention of Mr. Goodyear.* The possession of this material has enabled me satisfactorily to accomplish my original purpose, and finally to construct an instrument which, after the opportunity afforded by a year and a half's constant use for making necessary modifications and improvements, has continued to afford the patient uninterrupted relief from all impediment, and no inconvenience now occurs to remind him of the disadvantage under which he formerly labored. I soon found that I was in possession of a material which could be moulded to any required shape, possessing the highest degree of elasticity, and also the property of resisting the action of many of the most powerful agents of decomposition. This is certainly a somewhat rare combination of qualtities to claim for any one substance; but I may be excused for regarding Mr. Goodyear's preparation as truly wonderful, as I am certain that, without I had fallen in with it, I could not have proceeded further with my designs.

After this fortunate acquisition, I did not immediately hit upon the form or plan best suited to the purpose, and it was several months before I brought the instrument to its present shape, with which, however, I have every reason to be content. The present plan of construction may be best explained by a notice of the steps that have led to it. I first moulded a simple triangular and somewhat concave lamina of the material, of the same shape and size as the fissure. This I attached to the gold roof, so that it would descend obliquely downwards and backwards, until its inferior margin approached within about two lines of the concave surface of the pharynx. This method seemed to produce a decided improvement, though not so great as any one, I think, would have expected from seeing the position and action of the instrument, and that it did not in the least embarrass the muscular motion of the sur-

* Of the nature and details of Mr. Goodyear's invention I am not at liberty here to speak, as the invention is his property, and I might thereby hazard his interest in an enterprise which has cost him a great outlay of time, labor, and capital, and at present embarked in the manufacture of it for a variety of useful purposes. Mr. Goodyear has, however, always furnished me with a liberal supply of the material, to enable me to prosecute my experiments, and also freely imparted to me such information as to its nature and management as has contributed to the present successful result.

765 rounding soft parts. Though the impediment still continued in a great degree, yet some improvement was manifest when the patient made a louder effort of the voice than usual; whereas, formerly, and with the instrument removed, the imperfection of the voice was observed to increase in proportion to the effort made. It seemed desirable to render the closure more complete. With this intention, the size of the velum was increased by adding to the lower margin, and attaching a sort of wing to each wire, which, projecting obliquely forwards and outwards, laid upon the anterior surface of the columns or sides of the fissures. Thin wings, upon both the right and left sides, together with a corresponding flange projecting obliquely backwards and outwards behind the fissure, formed a sort of groove fitted to receive the columns. The result of this arrangement was, that upon the least contraction of the surrounding soft parts, the passage to the nares became completely closed, and the voice was necessarily compelled to find its exit through the mouth, in consequence of which its general character became considerably improved.

* * * * * * *

From our own experiments, referred to in a former part of this account, we are satisfied that the most ingeniously contrived metallic velum will not be found to afford any material improvements to the articulation, though it may assist deglutition; because an instrument made entirely of gold or other metal, so as to accommodate itself to the movements of the surrounding soft parts, and thus close the fissure without producing irritation, would require a very delicate and complex structure, such as must always be liable to derangement from any of the shocks to which, from its position, it would be constantly exposed. If, in order to avoid this contingency, the instrument is made upon a more simple plan, and stronger, then it will not possess the necessary delicacy and flexibility. These obstacles have often suggested the expedient of attaching pieces of gum-elastic to gold plates, which, occupying the same position as the natural velum, it was expected would perform its functions. We cannot learn that these oft-repeated plans have been brought to afford any permanent benefit, and, indeed, it seems to us they could not possibly succeed; for if the crude material employed is moulded to the shape required, its original form and consistency will soon be destroyed by exposure to moisture, animal heat, and muscular motion, all at
766 the same time. Added to this, the surface of the gum soon becomes coated with a deposit of the farinaceous particles of the food, besides the tartar and other impurities, which must very soon render the continued use of the instrument highly objectionable.

Mr. Goodyear's mode of preparing the caoutchouc enables us at once to get rid of all these objections, as the material he furnishes is found to retain the peculiar pliability of the original gum, and also the equally important quality of durability in resisting the combined action of the destructive chemical agents to which it must be subjected; and for that very reason, it has no affinity for extraneous substances by which the adhesion and accumulation of particles is promoted.

The writer has already given a history of the progress of the invention of the instrument through all the stages which have brought it to its present plan and form of construction. It was his original intention, at this point, to present a more detailed description of the mechanism; but we are aware that such descriptions are not read by one in a hundred, as they are, at the best, very obscure, since mere words, without the aid of figures or drawings, must always fail to convey a satisfactory idea of any purely mechanical contrivance. In this particular case we could not

hope that diagrams representing objects bounded by irregular curves, and not by straight lines, circles, or geometrical figures, would afford the reader any clear notion of the affair, for the same reason that a student of anatomy would fail to acquire any practical knowledge of the shape and relative positions of the parts of the animal mechanism from drawings and plates alone, without the advantage of demonstration and private dissections. But in lieu of descriptions or drawings, the instrument itself may be seen, and the results of its application witnessed, by such as may have become interested in the preceding account. The processes employed in fabrication are also peculiar, and do not admit of description, but must be seen and practiced in order to be understood.

From having been induced, by peculiar motives, to employ so much time upon this subject, more than any one else is likely to do, we are perhaps enabled to add some further hints which will be of use to others who may hereafter engage in a similar undertaking. Durability of the instrument being secured by the nature of the material employed
767 in its construction, its efficiency depends upon its accurate adaptation to the shape of the surrounding parts. All mechanism of a complex nature must absolutely be avoided, that no prominent points or angles may be presented for the lodgement of food, or to obstruct its passage. It is necessary that it should possess the exact medium of flexibility, together with a perfect and permanent elasticity of substance. This will enable it to accommodate itself readily to the slightest muscular motion, so that it may be retained in place while eating, drinking, or even during sleep, without irritating the sensitive surface with which it is at all times in close contact. At the same time, it must possess firmness and consistency enough to sustain the force of sudden shocks, as in laughing, coughing, or sneezing, without the possibility of injury or derangement. Lastly, it must readily free itself from all accumulations of food, deposits of tartar, and other impurities which might obstruct its regular action, or cause fœtor. To make the instrument still more perfect, an attempt has been made to give the velum a delicate pink color, resembling that of the natural flesh. Though that would, of course, add nothing to its practical value, yet a good deal of time has been spent to attain this point, without complete success.

The application of the instrument has been attended with the following circumstances: From the yielding nature of the material employed, and the smooth surface given to it in the course of preparation, its first introduction would not be expected to cause any pain. At first some inconvenience was of course experienced from introducing a strange piece of mechanism into a region peculiarly sensitive to the presence of foreign bodies. This occasioned a flow of saliva, continuing for a few days, after which all inconvenience ceased. The first observable effect upon the speech was to give it decidedly more volume, and therefore render it more intelligible.

768 [From the American Journal of Dental Science, Vol. 1, New Series, October, 1850, No. 1, pages 1 to 12.]

[From the Dental News Letter, Vol. IV, No. 2, January, 1851, pages 59 to 63.]

On the use of tin as a base for artificial teeth.

DR. C. A. HARRIS:

DEAR SIR: In compliance with your request, made to me at the last session of the American Society of Dental Surgeons, held at Saratoga,

I send you the cuts representing the progressive stages and manipulations for casting and gilding whole under sets of artificial teeth with pure tin. I am aware that, in doing this, I am bringing into notice a system of practice which has hitherto been confined to a few only in our profession, and which will not, probably, at first view meet with general approbation, as it is yet a question, in the theory of some among us, whether tin is admissible in our practice, for constructing dental substitutes.

In the curative treatment of carious teeth, tin has been successfully used as a filling; and if it has ever been injuriously affected, it has been owing to the unhealthy secretions of the mouth; but we find that, in the absence of all the human teeth, as in the case of infants and old persons, the mouth and breath are more sweet, and the secretions more healthy than where they are all or in part remaining. Consequently, with proper attention to cleanliness, pure tin would be much less liable to be injured by that agent, when used as a base for artificial teeth, than as a filling, provided that the work is well adjusted, and does not cause excoriation. Where the mouth is wounded, or unhealed from the recent extraction of teeth, the tin in contact with such parts (as I notice in my experiments for temporary sets) becomes rough and corroded by the action of the buccal fluids, which are always acidulated when the mouth is in this condition. To prevent this, when I do not design to gild the work, I use a thin plate of gold under the tin, where it comes in contact with the gum.

769 The peculiar charm which gold possesses will always secure for it a preference, with many of our patients, to any of the inferior order of metals, even though they could be furnished with a superior article for real service and comfort at less expense. Some of our profession also consider it as empirical practice, for no other reason than the tinkerish way in which they are constructed, and the cheapness of the material, and fear that, if generally adopted, "this our craft is in danger to be set at naught."

But from all that I can learn from extensive experiment and inquiry, notwithstanding the objections urged against it, I am still of opinion that pure tin, gilded or without gilding, upon a thin gold plate, may be used in all cases of whole or fractional under sets of artificial teeth, with more comfort and advantage to the patient, and with less expense and labor to the operator, than is possible with the use of gold alone. The evidence which I have collected in favor of this system of practice appears to me sufficient to establish the fact that it is no longer matter of inquiry or experiment whether tin be admitted in our practice as a base for artificial teeth, but that it is a scientific truth, and that every practitioner will, upon examination, find it his duty to recommend it to his patients, as best suited to secure the advantages which they require.

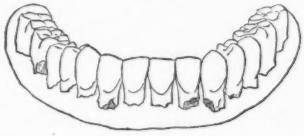
The manner of constructing sets of teeth upon this plan may be varied in different ways, and produce the same results. For fractional sets, it will be necessary to prepare, in the usual way, a thin gold plate, and strengthen that part which comes in contact with the natural teeth which remain in the mouth. When the plate is adjusted, place the wax upon it, and cut it to the right curve and the proper height for the length of the teeth. The teeth are then to be selected and placed around upon the wax, in the proper position for use; but it is not material that they come down to the plate, provided all that remains in view is properly arranged, as all below will be filled with tin when the process is completed. Plaster and sand are now to be put on the outside of the teeth and plate, in the same manner as though they were to be

soldered in the usual way. When this is done, the wax may be cut away, the teeth removed from the plaster, and a thin gold back put upon them. In backing them, it will be necessary to bend the platina wires over the gold. The backs may even be soldered to the
770 plates, either by the blowpipe or soldering iron, thus forming one solid mass of tin, covering the wires, and imitating, as nearly as possible, the form of the alveolar ridge which has been absorbed. When this is done, the plaster may be taken away, and as much tin put upon the front as will restore what has been lost by absorption of gum and alveolar process. When the piece is properly trimmed and burnished, it makes a very strong and natural set of teeth, in appearance, while the additional weight given it by the tin keeps it in place better than those made in the ordinary way.

Whole under sets of teeth may be cast of pure tin with great facility, dispensing with all metallic castings and plates of every kind, in the following manner:

After the first cast is procured, which should be made of plaster with a large proportion of sand, fit to it a plate of tin, as thick as can be well rubbed down with a burnisher, and as large as a plate of gold should be. The wax is then put upon the tin plate, and trimmed to the proper curve and height, as in the ordinary practice. Next arrange the teeth upon the wax, taking care that they do not come in contact with the plate by about the sixteenth of an inch. It is not necessary that the teeth should be lined, but the platina wires should be bent divergingly. The teeth may be broken off with a hammer, or ground, as most convenient, and arranged in a manner similar to the following cut:

FIG. 1.



Then place a strip of wax around the bottom of the front side of the teeth and plate, concealing all the ragged ends and

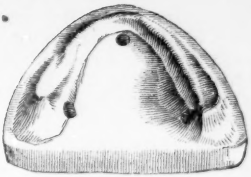
FIG. 2.

bad joints. All the wax is now to be carved to represent the natural gums, and to supply the required fullness. (See Fig. 2.)

Care must be taken to select such teeth as have their platina
771 pins low, so that they may remain imbedded in the wax after the carving. When this process is completed, oil the plaster and sand cast, and place the teeth and wax upon it, and pour over them more plaster and sand, so as to cover the whole with a thick mass. After the plaster is thoroughly hardened, the mould may be parted, and the tin plate and all the wax taken away, leaving the teeth secured in the plaster, as Fig. 3 illustrates:

Fig. 3.

Fig. 4.



Apertures must be constructed in the plaster, into which to pour the melted tin, and also for the escape of the air at points which will not interfere with the subsequent finishing, as marked in Fig. 4.

After washing the platina pins with a flux of muriate of zinc, the two parts of the mould must be securely bound together, and to insure perfect success the whole should be slowly heated to the temperature of the melted tin, which it is now ready to receive. Heat pure tin just sufficiently to flow readily, and carefully pour it into the place prepared. When sufficiently cool, remove the plaster, and prepare to polish, first with the file, then with different qualities of sand paper, which executes this work with great facility. Then finish with the same care as for gold. (In cases where gum teeth or blocks are required, the above directions cannot be explicitly followed, as the teeth must then be wholly supported at the base and on the inside.)

The patient should now wear the teeth a few days so as to become satisfied that they are well adjusted, and that no subsequent alteration will be necessary, as it would deface the work were it done after gilding.

To prepare the set for gilding, a thorough cleansing is necessary, and unless this is effectually done the adhesion between the tin and gold will be imperfect, the gold separating from the tin in burnishing, and easily rubbing off. In this process all grease must be removed by the use of
772 alkaline solutions and afterwards water, then, guarding against the moisture of the hand by a glove, perfectly polish the tin with a jeweler's soft brush and prepared chalk. Again rinse in water to remove all extraneous matter, and immediately place the teeth in the gilding solution. During the process of gilding the teeth should be removed two or three times and burnished, both to give solidity to the deposit and to discover imperfections if any exist. When the gold is sufficiently thick burnish in the usual manner.

I have not fully decided in my own mind that the constructing of sets of teeth without a thin plate of gold, as first described, is the best method; neither do I as yet feel prepared to speak positively as to the durability of gilding when worn in the mouth, as it is only about one year since I introduced the method into my practice. A few days since I made a thorough examination of the case, and could not discover any appearance of the gold wearing off.

This is for me sufficient encouragement to pursue the system until time shall render its true and impartial verdict concerning it.

The experience of Dr. C. O. Crosby, of New Haven, corroborates that which I have given, and has the advantage of much longer trial. In answer to some inquiries, he writes to me thus: "Mr. has worn his under set, constructed upon tin, for nearly three years, and still perfect. Another patient, Mrs. , has a set, which has been in use for two years, still in good condition, but has a silver base or

plate, is filled in or loaded with tinners' common soft solder, galvanized with silver, a thin coat, and burnished, and then galvanized with gold, about three coats, and burnished each coating. There is about two dollars and fifty cents' value of gold on each plate. I have about sixty plates made upon this plan. Soft solder plates look dingy unless well galvanized with gold. The galvanizing will stand if there is any gold put on, and they actually require less cleaning, from the fact of the gold being pure. There is no galvanic action when all the other metals are covered. I consider tin alone, without galvanizing, better and having less taste than eighteen carat gold, with copper, silver, and gold for solder. I have never found a person that could not wear them."

Dr. William A. Royce, of Newburgh, the pioneer in this practice,
773 has also kindly sent me an account of his experiments, which I forward to you to use as you judge proper; and with many good wishes for the success of your valuable journal, and for the rapid advancement of our important profession,

Allow me to remain, truly, yours,

GEORGE E. HAWES.

Experiments in the use of tin for insertion of teeth. By W. A. Royce, dental surgeon, of Newburgh, N. Y.

My first effort was made in 1836, for a lady, aged about sixty, who had lost her inferior incisors and some adjacent teeth, in a sound and beautiful state, by harsh brushing, and desired me to replace them with little or no expense.

After an impression and plaster cast were obtained the ejected teeth were cut off near the end of the root, and perforated with a small drill, and strung upon a silver wire; then placed on the plaster cast and supported by the wire around the plaster teeth in proper position, and at such space above cast of the gum as would permit molten tin to flow beneath the teeth; after which a curb was constructed around the teeth and gum, properly dried, and the tin poured in, thus forming a base fitting the gum and clasps to the permanent teeth, and holding the inserted teeth firmly. Filed, polished, and introduced, it gave great satisfaction until the death of the patient, which occurred some eight or ten years thereafter.

My second use of tin was in 1838, for a lady aged about forty, to insert her own incisors, which had fallen out, and afford support to an entire upper set by spiral springs; tin base to rest upon gum and badly worn down teeth, and attach to a few loose, attenuated teeth; a temporary resort for a patient imbued with more fear than discretion.

The tin base enclosing the teeth was stereotyped over the gum and teeth, as in first case, and filed, fitted, polished, and springs attached.

Calling some two or three weeks thereafter, she said it had caused her much pain, but was then comfortable; and it was a long time in service, with about the usual results. I became prejudiced, however, against tin to lay on the gum, and used but one more, without plate, to lay on the gum. This third case was a tin base, in an entire upper and lower case, for a gentleman about sixty-five, whose saliva was so
774 inert that sixteen-carat gold plate would not tarnish sooner than eighteen carat usually does. He wore, and used severely, his teeth for about two years, when I struck and fitted a gold plate, of about No. 30, and stereotyped the tin on it, embracing the teeth which had been freed from their former base for this melting. An accident occurred in this experiment; the tin used was too hot, and amalgamated

with the gold plate just where the current of molten tin impinged on it. Thus I learned that tin should not be hotter than barely to produce limpidity. I think I did not misjudge when, after several years' use of these cases, I abandoned the employment of tin for the part coming in contact with the gum. It did not produce irritation on the central part of the gum, but toward either outer or inner border, in contact with integuments, often abundant and sensitive, it seemed to me to be more irritating. Tin will corrode in contact with excoriated surfaces in the mouth, and throw up a slight pile of gray (chloride ?) compound, insoluble in the salvia, somewhat harsh to the feel, crisp to the file or scraper, and at least mechanically irritating to the excoriated surfaces which caused it.

My fourth experiment was for an elderly lady—mouth totally toothless; desired the lower denture only, on a very broad inferior maxilla and large alveolar ridge, to match the teeth in a small superior maxilla and gum. This was another nothing, or next to nothing, pay case; but I attempted to better my former practice, and struck and fitted a silver plate; set French teeth with silver-wire studs soldered to plate; stereotyped the tin gum on the plate; gilded all the parts finely and prettily. Thought I had made a fine advance. It was tried fairly for several days, and proved to be a superior sialagogue. I question the superiority of mercury to produce ptyalism.

My fifth effort was to insert an entire upper and lower denture; lower gum narrow and summit thin. The teeth were mounted in the usual way on gold plate, except the metallic gum was tinman's soft solder, flowed around the teeth with a tinker's iron. Twelve or eighteen months' use showed the gum shelling off, a black and separating mass, like the moss on the bark of a forest tree, another mortifying experiment, but easily remedied by substituting pure tin for tinker's solder.

The sixth experiment was the same as the fifth, except the lower gum was wider, and silver linings were used, and the tin made to serve both to fasten the teeth and load the plate. The
775 silver linings evinced galvanic polarity, causing frequent pricking shocks to the tongue. Gold-lined teeth were substituted, and the shocks obviated. This experiment, made in 1841, has decided all my practice since. I get up my lower cases, when entire, about the thickness known as No. 30; strike the plate about one-sixteenth to one eight inch extra wide; curve up the edge the extra width on the outer border; coat the upper surface with pure tin, using a tinker's soldering copper, and saturated muriate of zinc as flux. The teeth are next arranged so as to articulate properly; but if admissible, their lower ends are broken off, to permit a considerable body of tin to flow under them; line them with the same thickness of gold plate; place them in position, with wax on their lined faces; set them in plaster, and, when the wax can be removed, proceed to solder them by their linings, with tin, to the plate, filling all smoothly from tip of teeth to lower edge of gold plate; remove the plaster on the outside of the teeth, and fill up the interstices and base of teeth in such quantity as pleases; file off any excess of tin anywhere; preserve a thick, smooth border to the plate, both within and without the arch; scrape down all asperities not to be reached by the file; mat the surface with fine sand-paper; clean out the sand and burnish smoothly; then finish beautifully with flannel and chalk, which last will ever after preserve the cases cleanly, if used daily. By this method any or all the teeth are readily detached, set in new position, and re-secured ad infinitum. For fractional cases, gold plate should be heavier, and the clasps

soldered on with good solder, as in using the tin solder they become detached in use, or when repaired or altered.

Very extensive accommodations can also be afforded to the gum by taking the tin gum or teeth off over the misfitting section, bending the plate to fit, and again restoring the gum or teeth.

To stereotype the gum, instead of the process of flowing it on with a soldering copper, I have tinned the linings after riveting, set the teeth in position, placed pure yellow wax around the teeth just as I would shed the tin to be added; cast the whole in plaster, exposed the whole to such heat as would dry the plaster and cause the wax to be absorbed by it; cut an opening to pour the tin through before such drying; take a proper quantity of tin and fuse it in an iron spoon; watch the
776 fusion, and permit no greater heat than sufficient to cause the convex edges, which first are prominent around the edges, to disappear; in other words, to make the whole surface of the molten tin flat; then pour it in the plaster flask, and as soon as it has cooled break off the plaster, when the tin will be found to occupy precisely, or very nearly so, the exact place of the wax. Little sand-papering is generally all the trimming needed; sometimes certain spots may require a touch of the soldering copper.

The immunity against corrosion that cadmium possesses seems to indicate that it might be better than tin. I have not tried it. My efforts to coat tin with galvanic gilding were futile, as the gold very soon disappeared from the friction of aliment.

[From the American Journal of Dental Science, No. 1, Vol. IV, new series, October, 1853, pages 79 to 93.]

Application of artificial teeth, by the auroplastic principle. By Edwin Truman, dentist, London.

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It appears, from the foregoing remarks, that an entirely new material should, if possible, be found for the construction of the plate, either alone, or in conjunction with those already in use, to relieve the pressure on the soft structures of the mouth; and at the same time some method should, if possible, be adopted to procure certainty in the fit, combined with solidity and durability in the material. The substance used must be pure, and free from any evil or injurious effect on the structures of the mouth; it should not be hard, or rather, not much harder than the gums themselves; it should be capable of resisting the solvent properties of the saliva and acid, and should be easy of manipulation. Such a substance we possess in gutta-percha, and I purpose to show the method by which this substance may be used in the construction of artificial dentures, and be made the means of remedying the greatest defects now existing in them, from its possessing many qualities combined that are not to be so found in any other substance. I shall first point its peculiarities—not that it is a substance now unknown or unappre-
777 ciated, but because I think I shall show it to possess qualities that eminently fit it for the purpose of the dentist. It has been long in use for filling teeth, and has been used in the construction of false palates, therefore its qualities in the mouth have been well tested, even in its impure state, as until very lately the pure white gutta percha could not be obtained. This I presume to have been the reason why none of my professional brethren have yet introduced it into the manufacture of artificial teeth. I have, since its first appearance in this country,

been deeply interested in it, and have tried innumerable experiments with it. It is at present little appreciated, compared to what it will be, and I have no hesitation in saying that a tithe of its capabilities are not known, and that it will be turned to uses compared with which, in importance, its applications hitherto are as nothing. I will now enumerate some of its most important qualities and peculiarities, and show in what way they serve the dentist; and, in conclusion, I shall briefly detail the mode by which I intend to apply its usefulness to my art.

First, as to its purity. This must of course be our first consideration, and in considering this part of our subject, there are many points requiring attention. Is it capable of decomposition, producing an unhealthy influence? Does it become softened and offensive? These questions must be answered before we can apply it to our use. Is it a substance that can be retained in the mouth for a long time without detriment to the health of the patient, or injury to the surrounding tissues?

It is in its pure state one of the most indestructible substances known, and in cases under my own observation has been worn for years in the mouth without in the slightest injuring either the general health of the patient or the tissues that come in contact with it. I have used it now many years; and although it does not wear the same in all mouths, yet in none have I found the slightest ill effects. On the contrary, the mouths of patients having gutta-percha palates are so little inconvenienced by it, that after it is removed, it is impossible, upon examination, to tell that any artificial work had been there. This is not the case even with bone; and with gold worn for any length of time, a distinct mark is left upon the gum, the whole of the surface covered by the plate being a darker red than the rest. This is, perhaps, no very great defect; but I mention it as a proof of the inoffensive nature of gutta-percha, in the use of which substance it never happens. Bone worn in the mouth
778 sooner or later decays, and in so doing becomes black, soft, and offensive, and must be replaced, the whole structure being useless. When durability therefore is a matter of consequence, gold must be employed instead; as it is in all cases more or less. No two cases fit the mouth equally comfortably and well; and nothing is more annoying, after a set of teeth have become comfortable and the mouth accustomed to them, than to find from decay that they are worn out and a new set requisite, which, like new shoes on tender feet, must be worn some time before they are easy. These defects do not exist with gutta-percha; it does not decay in the mouth, and, if it did, it would not be accompanied by the same disagreeable consequences as ivory.

I have had some cases worn nearly three years, that remained the same as in the first hour they were made. Others, by the friction of the mouth and food, become slightly abraded at the edges; but never softened, never inherently offensive. When any offensive odor does exist, it is from foul breath, want of cleanliness, or from diseased stumps, which the patient has refused to have extracted (an operation it is not in the least necessary to undergo when gutta-percha is used). Experience, therefore, has fully answered the question of its purity. There is, however, one more advantage: even should it wear away, it does not spoil the case, since it can be replaced at one sitting, at any time, and that without in any way altering the old comfortable artificial teeth to which the mouth has become accustomed; and this can be repeated to any extent.

Next, its specific gravity is very low, so that any structure composed of it, however large, is light in comparison to what it would be constructed either of ivory or metal; this is of great consequence to us, as

the lighter our artificial teeth are the better, providing we have sufficient strength.

This brings us to its solidity; and here would appear, at first sight, to lie its weak point, instead of which we have its greatest excellence. It will not alter its shape at any temperature under 100°, whilst at 20 degrees higher temperature it may be moulded to the most intricate shape with the greatest facility.

At a low temperature it is hard and unyielding, and at the usual temperature of the mouth it is sufficiently solid to retain its shape under any extent of pressure, and yet too soft to injure the structures on
779 which it presses. Its great elasticity, too, allows it to yield to resistance, only to return to its exact form again when the resistance is removed. It will sustain great friction with but slight effect, we may almost say with impunity, although at the temperature of the mouth the fine filaments on the surface become slightly raised by friction. I shall presently show my plan for obviating this, which, in some cases, would be a defect. I think it right to mention all its defects as well as good properties, that the knowledge of them may assist my fellow-laborers in their future experiments on this substance when used in the mouth.

Its durability, under the circumstances in which we place it, is very great. It is soluble in scarcely anything but strong spirits, as ether, naphtha, or chloroform. It is quite insensible to the effect of acids, and the strongest alkalies have no more effect. It is quite impervious to that great solvent, water; and, although I have had it in the mouth where heat and moisture combine under the most favorable circumstances for decomposition, for years, I have not found the least sign of decay.

Color.—If the white gutta-percha be taken for the base, it can be colored to the greatest nicety of tint. But here is another defect, and, I think, its greatest. Light affects it, and I do not think any color, unless brown, perhaps, will remain long uninjured, if subjected to light, as, like caoutchouc, light has power of turning it brown, the color that is seen in general use. In the mouth this does not happen to any extent, as mostly the mouth is dark, and those parts forming the gums, I shall show, should be covered with certain substances to protect them.

Fine texture.—This is a quality pre-eminently possessed by this substance, and one that is of the greatest consequence to us. I am told that since its introduction it has been used by seal engravers to try their impressions on, in preference to sealing-wax, as it gives a finer impression. I have a piece that I moulded to the side of a shell, that has the prismatic colors transferred to it, which I think as great a proof as can be given of its capabilities in this respect. In use in the mouth, the impression is far more beautiful than in wax, the slightest peculiarity of texture in the mucus membrane being represented.

I shall now proceed to give a detailed account of my plan for availing ourselves of the advantages of this material. I shall follow the
780 same plan here that I pursued in my discussion of the artificial teeth now in use; give the process of manufacture, stage by stage, until we have the complete artificial teeth. I shall then show the method of adapting them to the mouth, after they are finished, and how we can regain any certainty that we have lost in manufacture, and, in conclusion, say a few words in comparison of the different methods.

First, I take the best model that I can obtain in wax, in the usual way, and prepare a plaster cast from it, in which I do not attempt to rectify any defects, as that can be better done in a future process; this

plaster cast I render as hard as possible with resin and wax in equal proportions, which renders the plaster impervious to water and enables me to immerse it in cold water with impunity.

This being completed, I construct a gold-wire frame in such a manner as to support the different artificial teeth firmly in their places, and likewise give strength to those parts where the gutta-percha is necessarily thin, as behind the front teeth in the lower jaw. This frame I firmly solder together, rendering it alone as strong as the complete structures on the old plan; but I construct it in such a manner that in the finished teeth it is imbedded in the centre of the gutta percha, and no part of it allowed to touch either the gums or remaining teeth, its only object being to give firmness and strength and to attach the teeth.

I then proceed to mould gutta-percha around this frame on this plaster model in such a manner as to produce the shape required for replacing all the deficient structures of the mouth, placing the mineral teeth already prepared on the pins fixed for their reception, and moulding the gutta-percha around them so as to replace the sockets and gum originally existing around the natural teeth. This structure may then be finished to such a nicety as to represent accurately every peculiarity of surface.

Then I place the work in the mouth at a temperature just sufficiently high to enable the gutta-percha to be moulded to the mouth itself, and thus it receives the shape it is to retain until quite finished.

I then remove the mineral teeth, leaving the sockets that receive them empty, and the gutta percha on all sides apparent preparatory to my last process, this being to cover all the surfaces that come in contact with friction either from the tongue or cheeks with a strong
781 plate of gold, which may be obtained by the electrotype process, being particular not to have any gold in such a position that it can possibly touch the soft parts under, in pressure, during the action of the mouth, but allowing it to dip into every socket for the mineral teeth, thereby giving them great strength. The teeth are again replaced, and fastened on the gold pins in their sockets, and all that portion of the gutta-percha that represents the gum I either color by means of pigments or enamel the surface of the gold which has been allowed to pass over it. This completes my artificial teeth without one destructible or defective material being used, and yet without subjecting the gums to any hard, unyielding substance.

I then immerse them in water at about 120 or 130 degrees, which accomplishes two objects: first, removes any unpleasant sensation from the cold metal; and secondly, enables the gutta-percha to intimately adapt itself to its resting place, whilst the mouth is in action for the first few minutes, and so to receive from the mouth itself the form that it is to retain, and thus rectify any imperfection in the plaster cast or wax impression.

In conclusion, I have to compare the old system with the one I advocate. First, in the latter we rectify all uncertainty that existed in the former as to fit; next, we remove the pressure of hard substances, and equalize the pressure on the parts beneath; then we are able, from the exact fit obtained, to dispense with any fastening whatever around the remaining teeth; even in whole sets the spiral springs are not required. I have many whole sets on this principle now in use that are more firm without them than they have ever been with them on the old principle. The irregularities of the remaining teeth, that stood so much in our way, are of great use to us in the new system, as they tend to support and steady the artificial structure that we have been enabled to mould directly to them, without having recourse to

those duplicate impressions so compatible with certainty. In fact, we take nature's own plan in rectifying defects; the surrounding parts mould the new structures to suit themselves; whilst, in the old system, any alteration or allowance that took place after the artificial teeth were in the mouth was affected by the new teeth on the mouth, instead of the mouth on the teeth; and I need not say which is the better.

For durability, I am sure it can compete with the old plan; and
782 all those perplexing little accidents so common in the best work now will be prevented by the extra strength obtained, and the support given to the teeth by the new sockets. What I have shown will, I think, be apparent to all who wear artificial teeth, and even to those who are unaccustomed to their use. Of one thing I am confident, that none of my professional brethren will gainsay one word that I have uttered here, and that this method will be adopted in all those cases adapted to its use, which are innumerable.

I find, since writing the above, that some dentists have given an unfair report to their patients of my plan. Such a proceeding scarcely deserves comment; of all new plans, jealousies will occur. The majority, however, have given me a favorable decision; to some I have granted licenses, and done cases for others that they might test it more fully. I shall still be happy in any way to further their views, if practicable. Should the public ear be abused by unfavorable reports of my plan, I can only say, "See it and judge," which can at any time be done, without fee, by granting me the favor of a visit.

[From the American Journal of Dental Science, Vol. IV, new series, October, 1853, page 176.]

Artificial teeth attached to an auroplastic base.

Mr. Edwin Truman, dentist, of London, has recently published a treatise on the application of artificial teeth upon the auroplastic principle. The base is formed of gutta percha, and the exposed surface plated with gold by means of electro-galvanism. The author has secured to himself the exclusive right of the principle by letters patent. We publish the treatise entire, except the preface, among the selected articles of the present issue of the Journal. Whether artificial teeth mounted upon a base of this sort will stand the test of experience, is, we think, more than questionable. We believe, therefore, that we hazard little in saying, a priori, that the substitution of it for gold and platina, the metals now generally employed, for this purpose, will never become general.

In alluding to the use of gutta-percha as a base for artificial
783 teeth in a former number of the Journal, we stated that we believed Dr. Hill, of Norwich, Ct., was the first to test its applicability for this purpose. He informed us by letter, about four years ago, if our memory serves us correctly, that he had then made some experiments with it, which promised the most satisfactory results. We should be glad to hear from him again upon the subject, and learn to what extent his expectations had, by his subsequent experience, been realized.

[From the American Journal of Dental Science, Vol. IV, new series, January, 1854, pages 223 to 226.]

Application of artificial teeth by the auroplastic principle.

NORWALK, CT., *Nov. 9th*, 1858.

Dr. C. A. HARRIS:

DEAR SIR: In the October number of the American Journal I noticed

an article entitled "Application of artificial teeth by the auroplastic principle, by Edwin Truman, dentist, London."

In referring to this article in your editorial, you observe: "In alluding to the use of gutta-percha as a base for artificial teeth in a former number of the Journal, we stated that we believed Dr. Hill, of Norwich (should be Norwalk), Ct., was the first to test its applicability for this purpose. He informed us by letter, about four years ago, if our memory serves us correctly, that he had then made some experiments with it, which promised the most satisfactory results. We should be glad to hear from him again upon this subject, and learn to what extent his expectations had, by his subsequent experience, been realized."

It will be my pleasure to respond to the wish so courteously expressed in the paragraph just quoted, and I will now proceed to give the result of some experiments with the substance referred to.

784 My experiments with pure gutta-percha as a base for artificial teeth were by no means satisfactory. It is too stringy and elastic in its pure state to be used with much convenience. I therefore made a compound, similar to the article known as "Hill's Stopping," with which I was much better satisfied, and which I subsequently used as a base for artificial teeth.

With this compound material my experiments have been chiefly made. My method is as follows: After having secured and prepared my plaster model, I cut out a rough pattern for a plate from the compound material, which is rolled out into a sheet about the sixteenth of an inch in thickness. This I immerse in hot water, when it immediately becomes soft and plastic. While plastic I press it with my thumb and fingers where I wish it to go upon the model, occasionally immersing it in the hot water as it becomes cool, until it be made to take the precise shape which I desire. It is now to be trimmed and dressed until the edges are smooth and true.

It is necessary that the alveolar border should be quite thick. This can be easily made so by adding small strips until the required thickness is obtained. When this is done, it is ready to receive the teeth, which may be secured as follows:

If the pivot teeth are used (and they can be in many cases with satisfaction), I proceed as follows: I sit down, with my model before me, with a small spirit-lamp lighted at my right hand. After selecting the tooth which I design to use, I seize it with a pair of common pliers and gradually heat it in the blaze of the spirit-lamp (it requires but little heat), and then press it firmly in its bed on the aveolar border, just as I wish it to stand when in the mouth. And thus I proceed, until the teeth are arranged, occasionally trying the piece in the mouth, to see that it is all right. Supposing the teeth to be all right in their arrangement, I next proceed with a small flat smooth-pointed instrument to lay the compound all around the base of the teeth, in a solid and substantial manner, occasionally heating my instrument in the blaze of the spirit-lamp, and massing it down. If ordinary plate teeth are used, they should be lined, or backed in the usual manner for setting on plate, only leaving the backings longer than is customary for soldering on plate, and allowing it to turn out a little from the tooth, so that the compound can cover it, and retain it firmly in its place. This can be done so as to give great strength to the teeth, when properly arranged. All this can be done in less time than it will require to write these directions, save, perhaps, the backing of the teeth.

785 I suppose the teeth now in use in Dr Allen's process of continuous gums will answer a better purpose for this kind of work.

Such, in short, is my plan of setting teeth on a compound base. It will be perceived that any required shape can be given to the gums, and any irregularity in the alveolar ridge easily adjusted; a portion of the compound I prepare of a gum color, and lay it on as may suit my convenience or taste, with my small, smooth, flat instrument, heated in the blaze of my spirit lamp. The whole process is very simple, and much easier executed than the method adopted by Mr. Truman, of London.

Let us consider the objections to this way of mounting artificial teeth. The objection does not lie on the ground of non-retention of the teeth. If proper care is observed in mounting them, they will bear any legitimate use in mastication. They will also continue useful for several years, as my experiments will show.

But the great objection in my mind is, they will not retain their proper color. I have succeeded in making a beautiful gum-colored compound, and can paint them with various shades of the same article, and when first used look exceedingly well, but they will change color in the mouth, and look bad enough after a little use. If this difficulty could be obviated, I should think much better of the plan. But I see not how it can be, until we impart to it an enameled surface, which is not likely soon to be accomplished. A flesh colored compound would indeed be desirable, but I have not yet succeeded in making a gum color that would not fade, or turn dark and livid, under the influence of the action of the fluids of the mouth. A simple compound like the "stopping" operates the best, in the long run, of any I have tried.

Temporary sets may be constructed on this plan, with great facility, and at a small expense, answering a very good purpose. Indeed, I should think them altogether preferable to the English bone, or hippopotamus base, and they may be renewed or entirely reconstructed at any time, with little difficulty.

For under sets this article is peculiarly adapted, inasmuch as it is so easily moulded to any desirable form. And the base can be made so thick and strong as to endure any service. And the teeth are firmly held in their places by being stuck into the compound when slightly heated, without any other support. It will afford sufficient weight to the piece, and bulk to any extent. Where one or more grinders are lost, this plan furnishes a simple and economical substitute, as they may be retained without clasps or ligatures.

786

If thrown back twenty years, I should certainly regard this as a great and useful invention. And even now it may be regarded as a great convenience for temporary uses. But otherwise I have little satisfaction in this kind of work, since I have seen the beautiful block and continuous gum work of the present day. As to strength, there is no difficulty; and in some cases it may be made really handsome. But it is not easy to overcome our predilection in favor of the precious metals as a base for artificial teeth.

I have thus, my dear doctor, endeavored to give you a very brief description of my experiments on the "auroplastic principle," and would be pleased to communicate more specific information regarding it, either to yourself or any other member of the dental profession, if desired so to do at any time.

Very truly, yours,

A. HILL.

P. S.—I do not understand how gold can be deposited directly on gutta-percha by means of the galvanic battery, as set forth by Mr. Tru-

man, of London. If this can be done, a great point will be gained as to the success of these experiments, and the principal objections obviated.

Perhaps you can give me some light upon this subject. If so, I would esteem it a special favor.

[From the American Journal of Dental Science, Vol. VI, new series, July, 1856, pages 477, 478, 479.]

India-rubber base for artificial teeth.

In a previous number of the Journal we took occasion to notice the application of vulcanized India-rubber as a base for artificial teeth. A few weeks since we received the following communication from Dr. Mallett, dentist, of Hartford, Conn., giving the result of a series of experiments in the use of this article, which cannot fail to be interesting to our readers; therefore, rather than permit the communication to
787 lay over until our next issue, we introduce it into the editorial department of the present number—the proportion assigned to original communications having been closed previously to the receipt of the article.—[EDS.]

INDIA-RUBBER TEETH. By Dr. SAMUEL MALLETT, Dentist.—Some fugitive notices have, from time to time, appeared in the public prints regarding the use of hard rubber for dental purposes, but I believe no one has described anything of a practical nature respecting this article for the purpose named. The idea has been in many minds that it would be accomplished, but how the thing could be done has been the question

The first piece of work of the kind which in any manner resembled a set of teeth was an upper set; plate, teeth, and gums all of hard rubber, and in one piece, being made by Mr. F. A. Bevins, in the employ of Mr. Goodyear, by moulding an artificial set of teeth in plaster of Paris, and filling the whole with sheet rubber prepared for such purposes. This was then subjected to the influence of steam, and in the process of vulcanizing a kind of fusion of the rubber took place, which caused every portion of mould to be filled, making an exact copy of the case of teeth which was used. But notwithstanding the adaptation to the mouth was most perfect, it would not answer for practical purposes; the color would condemn it, and besides, the teeth were not sufficiently dense to endure the friction caused by mastication. But subsequent experiments warrant a hope this difficulty will yet be overcome.

About this time Mr. Goodyear, now in France, sent to this country a partial set of teeth, the plate, gums, and clasps being composed of rubber, in connection with plain mineral teeth, inserted in the rubber, somewhat like gutta-percha teeth.

About this time, with the aid of Mr. Bevins, an experienced workman in rubber, I made a case of teeth in the same manner. But we were satisfied that this mode of doing the work would not go into very general use, unless the color of the gum could be made more closely to resemble nature, it being about that of mahogany. Many experiments were made to improve the color of the rubber, but they were unsuccessful in bringing it to a life resemblance. We then hit upon a plan of using single gum teeth, and soon a denture was produced which has been worn since that time with much satisfaction.

The durability of the work has surprised me. Although the
788 ordinary teeth were used with no attachments but such as were

made by the pins and the angles of the teeth, yet I do not see that they are more liable to loosen from the case than they are when made in the ordinary way of inserting them on gold plate; this is more than I at first expected of the work. The rubber has peculiar qualities. It has wonderful tenacity; when it is under the action of steam it expands and seeks vent, forcing itself between the particles lying on the surface of the object with which it comes in contact. To show the strength of it I will name that I took the incisor teeth of a case between my thumb and fingers and attempted to break them from their beds (these were gum teeth), but could not without breaking the plate in another place first. I am now using block teeth for this purpose, and I am satisfied that with the plan of making them which I have designed for this work, they will possess a degree of beauty and strength which cannot be excelled. The work is performed in the following manner: A plate is fitted to the mouth in the ordinary way, and if it is desirable to avoid swaging, gutta-percha may be used for the purpose of fitting. The antagonizing model having been taken and the teeth fitted as for other work, with the plate and teeth, by the means of wax, a perfect model is made, in outline of what it is desired the case should be when completed. It is important that this should be exact. A wax rim is made inclosing the edges of the teeth or blocks on the labial and lingual sides to represent the band and backings of the teeth.

The model is now to be moulded, the mould being made in sections so as to fit together very accurately; the teeth are then removed from the model and placed in their respective sockets in the moulds, the rubber being placed in the mould in sufficient quantity to fill it when vulcanized.

The mould being securely enveloped, it is submitted to the process of vulcanizing by confining it in a steam chamber for several hours; this done, the work is ready to be removed from the mould and polished.

Teeth should be made expressly for this work. There is no difficulty in making single teeth or blocks which shall be as strong as desirable. I have the block made with two or more excavations about one-eighth of an inch deep on the lingual side, with projections, and in these excavations are pins sufficiently long to allow them to be bent into any desirable shape. The block is also made thicker on this side than for ordinary work, tapered to nearly an edge, which is bevelled, so that an arch is formed conforming in this particular to nature. In the ends of the blocks, where they join together, large corresponding holes are made, into which the rubber flows, making connecting pins of great strength; the rubber also flows around the edges of the blocks, forming the rim on the labial and lingual sides and filling the notches even with the block, so that when the case is finished there is a uniform surface of rubber and porcelain, differing in appearance only in color; in other respects the blocks do not differ from those which are ordinarily made.

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There is a marked difference between the adaptation of metal and hard rubber for plates, and that very much in favor of the latter article. There seems to be more congeniality between the animal system and rubber than is found between it and the various metals used in dentistry. The slight elasticity which it possesses is very agreeable, so different from the rigidity of metallic plates that it cannot fail to be popular.

[From the Dental News Letter, Vol. XI, April, 1858, pages 170 to 173.]

Hard Rubber Base. By Samuel Mallett.

MESSRS. EDITORS: With the exception of a single communication to the American Journal, giving the results of my experiments in the use of hard rubber for plates for dental substitutes, I have contented myself with its use in my own practice, choosing to wait until time, the great crucible of nature, had proved, by actual experience and demonstration, its qualities for becoming a useful servant to the dentist. I have not wished to put my professional brethren to the trouble and expense of adopting any new improvement merely because I have taken the lead in its development; they have so frequently heard the call, "Lo, here! and lo, there!" that the time has come when all new things should be thoroughly proved before they are offered for universal adoption.

Having frequently received, since the first announcement of the
790 improvement, letters from my professional brethren and others, regarding the character of the work, in various particulars, I have thought it might be of use to state, through the medium of your valuable News Letter, that which may meet the inquiries of various individuals who are already interested, or may become so, and contemplate adopting it in their practice. And as some may think I have an "axe to grind," I will say here that I have no more personal interest in this matter than any dentist may have who is using it in his private practice. My labor and expense in developing it I cheerfully give to the profession. It makes no difference to me whether any dentist in the country adopts it or not; but it does make a difference with the public, who are so afflicted as to be under the necessity of resorting to the use of artificial teeth.

The value of the improvement—the value of hard rubber in constructing dental substitutes—I consider now to be settled beyond a question. Although the work has been slowly and cautiously adopted by the profession, and but comparatively few are making use of it, the time will soon come when its merits will be fully known and appreciated.

The universal testimony of those who wear rubber plates, having previously used metal ones, is that they are much more comfortable and congenial to the mouth than the metal, and this fact, other things being equal, must be a ruling consideration in an artificial denture. The manner of forming and packing the moulds was before described. A considerable skill and experience is required to fill the moulds with the prepared rubber, so as to secure success; if the rubber is not packed sufficiently dense, the moulds will not be well filled after vulcanizing; if packed too full there will be too great an overflow of the rubber, and a bursting of the mould if it is not very closely confined. From four to five hours are now required to vulcanize a case, or cases, for several may be done at once as well as one, the number depending entirely upon the size and capacity of the heater. If the case is not in the heater a sufficient length of time, or if the heat has not been raised to or continued at a sufficient degree, it will come out semi-hard, as it is called, and will prove tender and unfit for use: on the contrary, if it is steamed too much, it will be brittle and of too dark a color. The heat should be raised gradually to about one hundred and seventy degrees Fahrenheit,
and be continued about one and a half hours. It should then be
791 raised to one hundred and eighty degrees, and remain about one hour; at one hundred and ninety degrees, one hour, and from three hundred to three hundred and ten degrees, from one to one and a

half hours. The heat is ascertained by a thermometer, which has its bulb inserted in the top of the heater.

Wax plates will be found most convenient for fitting this work in the mouth; the plates should be twice as thick as a gold one, for the purpose of polishing on the lingual side. To prepare the wax in sheets for use, it is rolled with a rolling pin; when it is warm it may be rolled between two sheets of cotton cloth, or otherwise. If the plate becomes warped in fitting, it can be immediately corrected by placing it on the model, or, if it has become unequal by pressure, a new one can easily be made.

With this work we are sure of a fit, if the impression be correct, the rubber being steamed to the original model taken from the impression; as the vulcanizing of rubber answers to the fusion of metals, it is the same as if it were cast, every line and irregularity of the model being strongly marked in the plate.

Central cavities should be dispensed with in rubber plates, or, if at all used, they should be very small and shallow. There is a fortunate affinity in hard rubber for the mouth, which will enable every practitioner to dispense with this necessary evil, which is found in the use of metal plates.

If the plate is at all approximating to a fair fit, it will hold well after it has been worn a short time, even if it is so imperfect at first as to be retained in its place only by the aid of the tongue and cheek. The last case which I made, having no cavity, required quite an effort with the thumb and fingers to remove it.

Single gum teeth, sections, or blocks, may be used; those of the former, designed for cheoplasty, are well adapted to it. I have made use of continuous gums; this may be done by first forming the gum and teeth, and allowing the platina to project about the width of a line all around the edge of the gum for the rubber to close over and hold firmly. This makes beautiful work, but has no advantage over other teeth, as the case will be without seam or joints, whether single or other teeth are used.

The continuous gums require so much platina that the case be-
792 comes heavy and more likely to break by dropping, and then I have feared that the slight elasticity of the rubber would cause the gum to crack and finally give way, and thus destroy the case.

Rubber plates are very light, so much so that a case will not sink in water, and this feature, it must be conceded, is of great value; first, because it enables us to extend the plate and thicken in any manner we choose, for the purpose of restoring the face, without perceptibly increasing the weight of the set. I know of no kind of work which possesses the qualities of accomplishing this object as well as rubber.

Again, this feature of it will be appreciated when we consider the fact, that most accidents occur with the teeth out of the mouth, such as dropping or pressing them against some hard substance. Heavy cases are often broken by falling only two or three inches; rubbers case may be dropped one hundred times on the floor without breaking. It may be thrown across the room with but little danger of injury. With this fact, together with my experience with it in other particulars, I am not at all certain but that rubber plates will prove to be far more durable than any other known to the profession. I have not as yet had the first case to repair. If it should be necessary to replace broken teeth, it would be best to make a new plate. The rubber around the fractured tooth could be cut out, and the tooth removed, and another tooth fitted in its place, and rubber again steamed around it; but I do not consider that

the case will be in as good a condition as it was before the injury—it seems to destroy too much of the life of the rubber to steam it over. The rubber apparently undergoes some chemical change in the act of vulcanization. For this reason, if a failure is made, and it is found that the case is not sufficiently hard and tough, or has not flowed in every part where it was designed that it should flow, it is better to begin anew, rather than to place it in the heater and run it through again.

A few objections have been made to rubber plates, some of them by professional, and others by non-professional persons; but all of them, I think I may say, from men who have not had much, if any, actual experience with it themselves. A dentist of high standing averred to me in New York that he had seen cases that had absorbed the saliva of the mouth and were considerably disintegrated. I was bound to believe the gentleman, but it must have been caused by the use of
793 poor rubber, or by some imperfection in the manipulation. The plate might have been only semi-hard; I have never seen anything of the kind in my practice. I have an upper set now before me which has been worn as a temporary for one year; but not the slightest change or appearance of absorption having taken place is perceptible, the plate, by the action of the tongue, only having improved in its polish. The same person said that the plates heated the mouth, the same as a rubber shoe would the foot, by preventing the escape of perspiration. I can only say that nothing like this has ever come under my observation, and I do not think that hard rubber can produce this result; the trouble was more likely to have been caused by too large a cavity in the plate, in connection with the natural affinity of the material, causing too much atmospheric pressure. It has been said that block teeth sometimes break in steaming. I have only to say to this objection that I have never known it to occur.

There is not the least taste to the article, which can be easily proved by retaining a piece of it in the mouth for a short time. The sulphuric odor of a case which has not been worn is entirely destroyed by the saliva. From observation, and the testimony of those who wear them, rubber plates have more of an appearance of cleanliness, and are actually more wholesome than others.

There is one qualification to be made regarding what I have said about rubber plates, viz, for under sets, when the alveolar process is greatly absorbed, and the muscles are inserted at the very top of the ridge, it may be necessary to use work of greater weight.

The advantages of rubber base, as is seen, are mostly in favor of the patient, and yet I think the dentist will find it more agreeable to insert rubber plates than any other, especially swaged plates. There will be a saving of expense, and also of labor. A rubber plate will not cost any more than a silver one; and, further, what is for the interest of the patient will sooner or later be found to be for the interest of the dentist.

It is not probable that all practitioners of dentistry will run into the use of rubber plates at once. An apparatus will be needed that will cost something; a considerable experience and skill will be required to properly prepare the work, to attend to the boiler and heater; and the whole process must be carried through with carefulness and exactness, or a failure may be expected.

794 [From the Dental News Letter, vol. xi, No. 4, July, 1858, pages 253, 254, and 255.]

The Vulcanite Base. By C. S. Putnam.

MESSRS. EDITORS: The growing interest manifested among our profession everywhere on the subject of "What is the best material to use

as a base for artificial dentures?" is but a sure evidence of the powerful influence which will eventually be given in favor of that kind best appreciated for its comfort, neatness, and durability by the wearer; and by the dentist, for the unvarying accuracy and completeness of adaptation, as well as the comparative ease and facility with which it is prepared in the laboratory by the skillful operator. The interest has arrived at such a height now that facts in regard to the subject are wanted, not theories and misrepresentations.

The present object of the writer is simply to give a short statement of the rise and progress of the vulcanite base up to the present time, and to set forth some facts obtained from an experience of more than two years of constant use of said material in a practice of entirely artificial work. Let me say, first, that as to priority in its application to artificial dentistry, that is wholly creditable to Mr. Charles Goodyear, jr., and Mr. F. A. Bevin, neither of whom are dentists. The question as to who "has taken the lead in its development" is now so well understood that certainly no controversy is necessary on that point. Something else is required, however; for since the appearance of an article in your last number upon this subject, many questions have been provoked in regard to statements therein contained, and I, for one, take this opportunity and method of answering them by giving the result of my experience.

1st. It requires but two hours "to vulcanize a case or cases," instead of "four to five hours."

2d. The heat at "one hundred and seventy degrees Fahrenheit, continued one and a half hours, and then raised to one hundred and eighty degrees for one hour, and one hundred and ninety degrees for another hour," will have no more effect upon the material than if it were placed in sunshine during that length of time.

795 3d. Rubber plates, without the teeth, will "sink in water," and it is for some savan to prove hereafter that the teeth added will make it float. "If it should be necessary to replace broken teeth," it would not "be best to make a new plate." A case will be in as good condition after it is repaired "as it was before the injury." Temporary sets are often made over for the permanent by cutting away a portion of the plate and adding more material to conform to a new cast, and it does not "destroy too much of the life of the rubber to steam it over." If the case is "not sufficiently hard and tough," it is not "better to begin anew," but it should be made hard by additional heat. No piece sufficiently firm to hold the teeth can absorb "the saliva of the mouth" nor become "disintegrated." "The time has come" when it can no longer appear expedient for any one to speak of the work in a questionable manner; and though "a dentist of high standing" may aver and give a volume of opinions and theories on a subject upon which he is almost totally ignorant, it would, on the contrary, be quite as ridiculous for me to say that "I was bound to believe the gentleman." Block teeth will "sometimes break in steaming," and often in the process of polishing. If "the muscles are inserted at the very top of the ridge," it is not "necessary to use work of greater weight," nor is there any "affinity in hard rubber for the mouth." But there is doubtless a congeniality of the material upon the muscles and gums which none can fully appreciate without having first worn metallic plates; and if a plate of any material is worn with comfort without the "central cavity," it is truly from its more perfect adaptation than "fortunate affinity." "A considerable experience and skill" are not required to properly prepare the work, while a boy can "attend to the boiler and heater" after seeing it once done; and the "something" which an apparatus will cost com-

plete for use (instructions included) will not exceed seventy-five dollars.

It is but fair to state, in this connection, that the first apparatus which is now in use for dental purposes was established in May, 1856. In August, 1856, at the time of the dental convention in New York, the proprietor of the second apparatus called to ascertain the success and progress of the work, stating that "he did not wish to incur any expense until he knew that the work could be successfully made." In the fall of that year he employed the same engineer who made the first ap-
796 paratus to fit up a similar one for himself, since which time it has been generally understood that he has proved to be remarkably successful in constructing the "hard rubber base."

Many inquiries are still made in regard to the best style of teeth to be set in the vulcanite material. We would simply answer, all descriptions, from a single plain to a rim of continuous gum; or block teeth can, we believe, be more firmly secured than if set upon any metallic base. The pins of plain and gum teeth should be flattened with plyers and turned to form something like a head. A variety of such teeth may now be had of one of our dental establishments, designed expressly for the work, possessing every desirable qualification; and nothing now remains in the way of a more general introduction of the vulcanite base but the obtaining of some satisfactory terms from those having control of the patent for using the material. It is hoped, however, that all leading members of the profession will join others who are already doing the work in demanding a fair and liberal arrangement, so that those in the country can have equal privileges and facilities with those in cities.

[From second page of advertisements at the back of the Dental News Letter, vol. xi No. 4, July, 1858.]

The Vulcanite Material.

Dentists who wish to try this style of work can do so by observing the following—

DIRECTIONS.—Arrange the teeth upon a plate of gutta-percha, first pressed, while warm, upon a small plaster model of the mouth, forming wax inside and around the teeth, as may be desired in the vulcanite material, and forward the whole (teeth, plate, and model) to the undersigned, and the work ready for polishing will be returned on the day after its reception.

Any style of plate teeth can be used by bending the pins a little towards the cutting edge.

The first piece received from each dentist will be vulcanized
797 without charge. For each piece thereafter the price will be five dollars, which amount must invariably accompany the order. For polishing, two dollars extra.

C. S. PUTNAM,
35 *Bond Street, New York.*

[From the Dental News Letter, vol. xii, No. 4, July, 1859, pages 289 to 290.]

The Vulcanite Base.—Meeting at the Hanover Square Rooms.

On Wednesday evening, April 6th, Mr. Putnam invited the members of the dental profession to a meeting at the Hanover Square rooms, for the purpose of discussing various questions relating to the vulcanite base. Mr. Harrison presided on the occasion.

Mr. Putnam, in his address, observed that in calling the meeting he had acceded to the request of many gentlemen present; and, as he was desirous that the process should be rendered accessible to the profession, he would endeavor, as far as possible, to remove those difficulties which in a degree prevented some whose means were limited from at once enjoying all its advantages in practice. As to the terms on which he was prepared to offer his invention to the profession, he did not consider that he would be acting in justice to those who had already purchased licenses were he to reduce the fee without some intimation of their concurrence. He did not ask any one to protect him from fair or unfair competition; he was willing to acknowledge any improvement which may supersede that which he had introduced to their notice, and to yield to any superiority over the present system in the mode of manipulation, preparation of material, and principle of vulcanizing. In regard to his patented apparatus, he did not suppose that any one would give themselves the trouble consequent on an infringement of it, but in the matter of the hard vulcanite patent he believed that a few would like, if possible, to evade it in some manner. Mr. Putnam then read the letter which appeared in the Dental Review of last month, and in regard to two of the specifications referred to in that letter (Mr. Han-
798 cock's and Mr. Goodyear's) he was disposed to offer such information as he had been able to obtain, although nothing decided could be determined on except in a court of law. He would state, however, that a patent which involved this one or Mr. Goodyear's of 1851 (which letter was taken out in America simultaneously with the one now in question) was there strongly contested, a few years since, but fully sustained, notwithstanding these same specifications of Mr. Hancock of 1843-'46, and others, were produced as evidence against Mr. Goodyear's claim.

While admitting that the Goodyear patent has some weak points, he could not disguise the fact that Mr. Goodyear and his representatives are determined to prosecute those who infringe their patent; and should any such suit or suits be successful to Mr. Goodyear, then those who have used the material for a time without a license will be held accountable for the amounts they had received while using it in practice, with interest thereon up to the time of said decision. In conclusion, Mr. Putnam invited those who had insinuated that a new and improved process had sprung up (or was about to do so), different from what he first suggested to the profession in England, to come forward in a manly and honest manner and enlighten the profession as to their improvements and their knowledge of patents.

A lengthened discussion followed, several gentlemen giving it as their opinion that Mr. Hancock's patent of 1843 covered all that was required; that the patent of 1855 of Mr. C. Goodyear, jr., which had lapsed from non-payment of the fees, contained the whole process; that Mr. Putnam, by fixing the charge for his apparatus at so high a figure, had caused others to produce a vulcanizing apparatus at a less cost and with a fair and reasonable profit; and that if he would separate his own from Mr. Goodyear's patent, and charge a fair remunerating price for his apparatus, he would receive that encouragement from the profession to which he was justly entitled.

The proceedings terminated by a vote of thanks to Mr. Putnam, and to Mr. Harrison for his conduct in the chair.—LONDON DENTAL REVIEW.

799 [From the Vulcanite, vol. i, No. 1, May, 1860, pages 2 to 14.]

Vulcanite and its Uses.

The extensive and constantly increasing use of vulcanite in the dental art, and its great importance to the profession, seem to demand from us a more full and exact statement than we have yet given of the grounds on which we rest our claims to its exclusive use for dental purposes.

This we propose to preface by a brief history of the introduction of India rubber into the arts, and of the rise and progress of the vulcanized India rubber manufacture under the Goodyear patents. Caoutchouc is the gum or sap of various kinds of trees, growing in the forests of South America and the East Indies. It is collected by the natives usually during the summer months, by tapping the trees, as in the process of making maple sugar in the Northern States. The sap is of a yellowish white color, but congeals almost immediately on exposure to the air, and becomes of a darker color. The black color is imparted to it by smoking it over fires made of the wood of the tree.

India rubber was first known in commerce about the year 1770, when it was spoken of by Priestley as a substance just imported, and adapted to the removal of lead-pencil marks from paper; and an instrument maker in London sold small pieces, about half an inch square, at three shillings each, for that purpose.

The first importation into this country was made about the year 1800, but it was not until the year 1820 that it was used for any other purpose than the one above mentioned. In that year India-rubber shoes, of rude form, were made by the natives of South America, and imported in small quantities. This afterwards became a large branch of trade, which continued until the pure gum shoes were entirely superseded by the more graceful ones made under the Goodyear patents.

About the year 1830, the manufacture of rubber clothing and other articles was commenced at Roxbury, Mass. The gum used in
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The claims of this patent are as follows:

Mr. Putnam, in his address, observed that in calling the meeting he had acceded to the request of many gentlemen present; and, as he was desirous that the process should be rendered accessible to the profession, he would endeavor, as far as possible, to remove those difficulties which in a degree prevented some whose means were limited from at once enjoying all its advantages in practice. As to the terms on which he was prepared to offer his invention to the profession, he did not consider that he would be acting in justice to those who had already purchased licenses were he to reduce the fee without some intimation of their concurrence. He did not ask any one to protect him from fair or unfair competition; he was willing to acknowledge any improvement which may supersede that which he had introduced to their notice, and to yield to any superiority over the present system in the mode of manipulation, preparation of material, and principle of vulcanizing. In regard to his patented apparatus, he did not suppose that any one would give themselves the trouble consequent on an infringement of it, but in the matter of the hard vulcanite patent he believed that a few would like, if possible, to evade it in some manner. Mr. Putnam then read the letter which appeared in the Dental Review of last month, and in regard to two of the specifications referred to in that letter (Mr. Hancock's and Mr. Goodyear's) he was disposed to offer such information as he had been able to obtain, although nothing decided could be determined on except in a court of law. He would state, however, that a patent which involved this one or Mr. Goodyear's of 1851 (which letter was taken out in America simultaneously with the one now in question) was there strongly contested, a few years since, but fully sustained, notwithstanding these same specifications of Mr. Hancock of 1843-'46, and others, were produced as evidence against Mr. Goodyear's claim.

798

While admitting that the Goodyear patent has some weak points, he could not disguise the fact that Mr. Goodyear and his representatives are determined to prosecute those who infringe their patent; and should any such suit or suits be successful to Mr. Goodyear, then those who have used the material for a time without a license will be held accountable for the amounts they had received while using it in practice, with interest thereon up to the time of said decision. In conclusion, Mr. Putnam invited those who had insinuated that a new and improved process had sprung up (or was about to do so), different from what he first suggested to the profession in England, to come forward in a manly and honest manner and enlighten the profession as to their improvements and their knowledge of patents.

A lengthened discussion followed, several gentlemen giving it as their opinion that Mr. Hancock's patent of 1843 covered all that was required; that the patent of 1855 of Mr. C. Goodyear, jr., which had lapsed from non-payment of the fees, contained the whole process; that Mr. Putnam, by fixing the charge for his apparatus at so high a figure, had caused others to produce a vulcanizing apparatus at a less cost and with a fair and reasonable profit; and that if he would separate his own from Mr. Goodyear's patent, and charge a fair remunerating price for his apparatus, he would receive that encouragement from the profession to which he was justly entitled.

The proceedings terminated by a vote of thanks to Mr. Putnam, and to Mr. Harrison for his conduct in the chair.—LONDON DENTAL REVIEW.

799 [From the Vulcanite, vol. i, No. 1, May, 1860, pages 2 to 14.]

Vulcanite and its Uses.

The extensive and constantly increasing use of vulcanite in the dental art, and its great importance to the profession, seem to demand from us a more full and exact statement than we have yet given of the grounds on which we rest our claims to its exclusive use for dental purposes.

This we propose to preface by a brief history of the introduction of India rubber into the arts, and of the rise and progress of the vulcanized India rubber manufacture under the Goodyear patents. Caoutchouc is the gum or sap of various kinds of trees, growing in the forests of South America and the East Indies. It is collected by the natives usually during the summer months, by tapping the trees, as in the process of making maple sugar in the Northern States. The sap is of a yellowish white color, but congeals almost immediately on exposure to the air, and becomes of a darker color. The black color is imparted to it by smoking it over fires made of the wood of the tree.

India rubber was first known in commerce about the year 1770, when it was spoken of by Priestley as a substance just imported, and adapted to the removal of lead-pencil marks from paper; and an instrument maker in London sold small pieces, about half an inch square, at three shillings each, for that purpose.

The first importation into this country was made about the year 1800, but it was not until the year 1820 that it was used for any other purpose than the one above mentioned. In that year India-rubber shoes, of rude form, were made by the natives of South America, and imported in small quantities. This afterwards became a large branch of trade, which continued until the pure gum shoes were entirely superseded by the more graceful ones made under the Goodyear patents.

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The claims of this patent are as follows:

"What I claim as my invention, and desire to secure by letters patent, is the curing of caoutchouc, or India rubber, by subjecting it to the action of a high degree of artificial heat, substantially as herein described, and for the purposes specified.

"And I also claim the preparing and curing the compound of India rubber, sulphur, and a carbonate or other salt or oxide of lead, by subjecting the same to the action of artificial heat, substantially as herein described."

No sooner had this patent been granted, than infringers upon it sprang up in every direction. The boldest and most persevering of these was Horace H. Day, of New Jersey, who fought the patent with an energy and skill, and a lavish expenditure of money, worthy of a better cause. In 1852, after one of the most severely contested patent trials on record, the United States circuit court, then sitting at
801 Trenton, N. J., decided the case in favor of Mr. Goodyear, fully sustaining his patent. This decision put a stop to infringements for a long time, and no very important attempts have since been made to rob Mr. Goodyear of his dearly acquired rights.

We now come to a new era in the history of India rubber.

In the year 1849, Nelson Goodyear, a brother of Charles, being then employed in the manufacture of soft rubber goods, discovered that, by mixing with the rubber a much larger proportion of sulphur than was ordinarily used in the manufacture of the soft compound, and then subjecting the mixture to a high degree of artificial heat, a hard, stiff substance would be formed, entirely different in its character from vulcanized gum, and adapted to a great variety of purposes, such as combs, knife-handles, canes, etc. On the 6th day of May, 1851, he obtained a patent for this invention, which was surrendered by his administrator, H. B. Goodyear, and reissued in May, 1858, in two patents.

The claims of these patents are as follows:

"I do not wish to be understood as making claim broadly to a manufacture or substance produced by the admixture of caoutchouc and sulphur, nor as making claim broadly to a manufacture or substance by subjecting the compound of caoutchouc and sulphur, whether with or without other substances, to a high degree of heat; as, prior to the invention of the said Nelson Goodyear, caoutchouc and sulphur had been compounded, and such compound alone, as well as with other ingredients, had been subjected to a high degree of heat, but not to produce the manufacture or substance having the character peculiar to the said manufacture or substance invented by the said Nelson Goodyear.

"What is claimed as the invention of the said Nelson Goodyear, deceased, and desired to be secured by letters patent, is the new manufacture or substance herein above described, and possessing the substantial properties herein described, and composed of India rubber, or other vulcanizable gum, and sulphur, in the proportions substantially such as described, and, when incorporated, subjected to a high degree of heat, as set forth; and this I claim, whether other ingredients be or be not used in the preparation of the said manufacture as herein described. I do not wish to be understood, however, as making claim broadly to the union of caoutchouc and sulphur in the proportions named,
802 however these substances may be united and treated."

And again:

"But what I do claim as the invention of the said Nelson Goodyear, and desire to secure by letters patent, is the combining of sulphur and India rubber, or other vulcanizable gums, in proportions substantially

as specified, when the same is subjected to a high degree of heat, substantially as specified, according to the vulcanizing process of Charles Goodyear, for the purpose of producing a substance or manufacture possessing the properties or qualities substantially such as described; and this I claim, whether the said compound of sulphur and gum be or be not mixed with other ingredients, as set forth.

"H. B. GOODYEAR,
"*Administrator of Nelson Goodyear, deceased.*
"WM. H. BISHOP,
"WM. C. BROWN,
"*Witnesses.*"

It has been often asserted and many persons have been made to believe that these patents did not cover the variety of caoutchouc called gutta-percha: an examination of the above claims will show how erroneous are such assertions.

The first right sold under these patents was one to Conrad Poppenhusen, for the manufacture of artificial whalebone. This was soon followed by the sale of others for the manufacture of canes, boxes, buttons, combs, knife-handles, pencil-cases, and some other articles, all of which are still made by the parties to whom the rights were sold.

In the year 1856, the Beacon Dam Company, now the American Hard Rubber Company, of Connecticut, purchased of Charles Goodyear and Henry B. Goodyear, administrator of the estate of Nelson Goodyear, an exclusive right to manufacture all articles for which they had not already granted licenses. Under this grant this company carried on the manufacture of a great variety of useful and ornamental goods, such as syringes, tape-cases, powder flasks, telegraph insulators, whip-sockets, martingale rings, jewelry, etc.

It could hardly be expected that the owners of rights of so much value would be suffered to remain in the unmolested unjoyment of them; and no sooner had their value been demonstrated than—as in the case of the soft compound—infringers began their work. The most formida-
803 ble of these was the New York Gutta-Percha Comb Company, which, backed up by a heavy capitalist, and managed by two of the most experienced manufacturers of India rubber, engaged extensively in the manufacture of combs and other goods. Suits were immediately commenced against them by Mr. Goodyear for infringements upon his patents, which they made preparation to defend, and engaged eminent counsel for that purpose. The further progress of this suit and its results are told in the annexed circular issued by the said company:

New York Gutta-Percha Comb Company to their customers:

You are aware that suits have been pending for some time between this company, as defendants, and H. B. Goodyear, administrator of the estate of Nelson Goodyear, as plaintiff; and those who received the circular of this company, issued in December last, were probably impressed with the fact that the company felt sure they were right in their defense, and consequently had no fear as to the final result.

It was in this view of the case, and not with a disposition to infringe on the rights of others, that the business of the company was established and has been carried on; and it was not discovered until recently that certain proofs mainly depended upon could not be made available by practical demonstration; and what is worse, it was found that several of the witnesses, who all along were presumed to know all that was de-

sired on certain prominent matters, when put to the test of cross examination, would fail in having the necessary knowledge.

On learning these new phases of the case, a consultation was held with George Gifford, esq., the counsel of the company, which resulted in a written opinion, as follows, viz:

United States circuit court, southern district of New York.

HENRY B. GOODYEAR, ADMINISTRATOR ON THE estate of Nelson Goodyear, deceased,
versus
THE N. Y. GUTTA-PERCHA COMB COMPANY.

SIR: I have subjected to a most thorough examination all the
804 matters which you have furnished me to be used as a defense in the above suit, and as yet I have been unable to satisfy myself that they are sufficient for a successful defense; and I find that our expert, on whom we most rely as an expert, is very much in the same state.

I am willing to serve you in any proper way, but unless I can be aided with more reliable matter of defense than I have yet found or had, I shall consider it useless for you, and professionally detrimental to me, to enter upon a trial in this case; for, as I now understand it, I am satisfied we should be defeated, a result which I never enjoy, and in all cases wish to avoid.

Yours, truly, etc.,
(Signed) GEORGE GIFFORD.

New York, April 27th, 1859.

To WILLIAM RIDER,
Agent New York Gutta-Percha Comb Co.

Having the foregoing state of the case before it, with the often-asserted policy of the company, not knowingly to infringe upon the rights of any one, there seemed to be but one course to pursue, which was to make an arrangement to protect the customers of the company, and for closing up its business with as little loss as possible.

To this end negotiations were opened, which resulted in an agreement with Mr. Goodyear for the release of all claims on our customers for damages, by reason of selling our goods heretofore, as well as for what they now have on hand.

In conclusion it is proper to say, that having read upwards of eighty English, French, and American patents on the treatment of India-rubber and gutta-percha, and the chemists and workmen of the company made over two hundred experiments on vulcanization, we freely admit the justness of the verdict of the jury in establishing the validity of Mr. Goodyear's patent.

HOLMAN J. HALE,
Vice-President N. Y. G. P. C. Co.
WILLIAM E. RIDER,
Treasurer N. Y. G. P. C. Co.

Another company, chartered in New Jersey, against which a suit was commenced, soon after failed in its business, and the suit was consequently dropped.

We come now to a portion of the history of these patents
805 more particularly interesting to the dental profession. As early as the year 1853, this material, prepared substantially in the same

manner it is now used by the profession, was applied to the manufacture of plates for artificial teeth. Great opposition was manifested to its introduction; but it has gradually won its way into favor, until it is at the present time more generally used than any other material. Among the earliest to adopt the use of it in their practice was Dr. C. S. Putnam, of New York, to whom Mr. Goodyear, in consideration of the interest he took in its introduction, gave the title to one-half the right for its use in the cities of New York, Brooklyn, Williamsburg, Jersey City, Hoboken, and Hudson City, New Jersey.

The grant to Dr. Putnam, however, provided that neither Mr. Goodyear nor Dr. Putnam should sell office-rights for the territory in which they were mutually interested, without the consent of both parties. We are thus explicit in our statement respecting the rights of Dr. Putnam, because many have been led to believe, by means of a circular lately issued by Mr. K. A. Brigham, that they could obtain a right to use the Goodyear patents by only purchasing the compounds they used of the said Brigham.

With the history of infringements upon these rights, the profession have been made acquainted by us from time to time as they have occurred, but this article would, perhaps, be considered incomplete without a more particular reference to them.

In the year 1858, L. E. Christopher & Co., of New York, having purchased of the North American Gutta-Percha Company a pretended right to use gutta-percha in the manufacture of plates and gums for artificial teeth, opened an office in Bond street for the sale of office rights and vulcanizing for other dentists. They gave the name of coralite to their material, and induced many dentists to use it in their practice. As their proceedings were clearly in violation of the Goodyear patents, a suit was commenced against them by Mr. Goodyear in the United States circuit court; whereupon they soon after sold out to Mr. E. A. L. Roberts, and left the city. The energy and tact displayed by Mr. Roberts in prosecuting the business commenced by Christopher & Co. must still be fresh in the minds of the profession.

Another suit was immediately begun against him, which he made preparation to defend, by employing able counsel and entering an
806 appearance at court; but finding, on a thorough examination of the case, that a defense would be of no avail, he failed to appear at the time of trial, and a verdict was rendered against him with costs, and he has since paid damages to Mr. Goodyear. The decision of the court in this case is as follows:

U. S. circuit court, southern district of New York. In equity.

BETWEEN HENRY B. GOODYEAR, ADMINISTRATOR on the estate of N. Goodyear, deceased, complainant,
versus
EDWARD A. L. ROBERTS, DEFENDANT.

It appearing, to the satisfaction of this court, that the said defendant has infringed the rights secured to the complainant by letters-patent reissued to him on the 18th day of May, A. D. 1858, numbered reissues Nos. 556 and 557: Now, on motion of George D. Sargeant, complainant's solicitor, it is hereby ordered, adjudged, and decreed that a perpetual injunction do issue out of and under the seal of this court, restraining and enjoining the said defendant, Edward A. L. Roberts, his

clerks, attorneys, agents, servants, and workmen, from making, manufacturing, and selling to others, any plates and bases for artificial teeth or other articles which are made and manufactured of India rubber, or other vulcanizable gum mixed with sulphur or any equivalent thereof, either with or without auxiliary ingredients, in the proportion of about from four ounces to a pound of sulphur to a pound of gum; and then subjecting such mixture of India rubber or other vulcanizable gum and sulphur or any equivalent therefor to a high degree of artificial heat, substantially as described and claimed in the letters-patent as aforesaid.

And it is further ordered, adjudged, and decreed that the cause be referred to Kenneth G. White, esq., the clerk of this court, to ascertain and report the number of plates and bases for artificial teeth or other articles that have been manufactured and made according to the process patented as aforesaid; also the number sold by the said defendant since the 18th day of May, 1858; and also the profits which the said defendant has made or derived, by the sale of said articles, so made and manufactured as aforesaid since the time last aforesaid; and upon
807 the coming in and confirmation of said report, that said complainant have a decree and execution for the amount found due to him, and also for the costs in the suit to be taxed.

Dated New York, October 3d, 1859.

A true copy.

KENNETH G. WHITE, *Clerk.*

The assertion has been made by a respectable western journal that Mr. Roberts was bought off by Mr. Goodyear, or the Hard Rubber Company. This assertion is, however, entirely without foundation. No inducement whatever was held out to Mr. Roberts to withdraw from the contest, and we challenge the editor of the said journal, or any other person, to produce the least proof that such was the case.

Soon after the suit against Mr. Roberts was commenced, another was instituted against Dr. O. A. Jarvis, of Bleecker street, which resulted in an injunction against him.

We have also obtained proof of infringements on the part of a number of other parties against whom suits have been prepared, and would have been prosecuted before this, had not the death of Judge Ingersoll almost entirely suspended the action of the United States court for this district. Among others, we had prepared a suit against Doctor Dieffenbach of this city, for infringements upon the Goodyear patents, in vulcanizing or hardening his compound called Amber base. On learning of our intention, we were waited upon by Doctor Dieffenbach, who, after a full examination of our claims, proposed to purchase of us a right for his own practice in this city, and issued a circular, which may be found on another page of this journal.

We have thus far instituted legal proceedings only against parties residing in this city, trusting that the result of such proceedings would deter others in other parts of the country from continuing infringements they had been induced to commence by parties residing here. Notwithstanding our repeated warnings, however, and the great care we have taken to have our rights well understood by the profession, we learn from the reports of our agents and licensees that infringements are still carried on in many parts of the country. We presume many have been led into such infringements by those who have been selling a variety of compounds, some of them at exorbitant prices, repre-
808 senting at the same time that they could be used without infring-

ing the Goodyear patents. To such we would say that none of the compounds which have been offered to the profession under the names of coralite, amber base, Wheat's compound, Brigham's superior gum, free from sulphur, nor any other vulcanizable compound, can be used without the Goodyear's patent, and also that the compound sold by us and our agents at $3.00 per pound has stood the test of years, and is considered by such of our licensees as have tried all others superior to any of them. We would also here repeat what we have before stated, that in no case, when we are obliged to commence a suit, shall we grant a license without adding to our regular price for an office-right all the expenses we may incur in its prosecution. We are disposed to deal liberally with those who respect our rights; but our general interest in the patents of Mr. Goodyear is too great to allow of our regarding as unimportant their least infringement. The price we charge the profession for a right is small, compared with the advantages gained by its use and the greatly increased business which is sure to follow its adoption. The reports we are daily receiving from all parts of this country and Europe show that we have never overrated its value to the dental profession. No better evidence of this could be required than the list of names of our licensees to be found in another column of this journal. As it is our aim to afford to the profession every facility in our power for the use of other material covered by the Goodyear patents, we have made arrangements with Dr. Dieffenbach, by which his compound can be purchased of him and used by all our licensees who wish to use it, without additional charge for the right from him to do so.

We would caution the profession against being imposed upon by traveling agents, professing to sell rights to vulcanize. All our agents are furnished with a printed certificate of their agency, signed by our secretary. None of them are allowed to fill out or sign licenses; but their duty is to take orders, to be transmitted to us, and on their receipt the license, duly signed by our secretary, and Dr. Franklin, our general agent, will be forwarded from our office, No. 640 Broadway.

In conclusion, we would express our thanks to those members of the profession who have fairly and honestly accorded to us our rights; and would repectfully request that they will inform us, without delay, 809 of any infringement upon them by others. Justice to themselves, as well as good-will to us, requires that they should do this; and in order that they may know who are and who are not infringers, we annex a list of all our agents and licensees.

LOCAL AGENTS.

Wm. R. Hall, No. 832 Arch street, Philadelphia, Pa.
Wm. A. Bevin, 13 Tremont street, Boston, Mass.
J. M. Brown, cor. Fourth and Walnut streets, Cincinnati, Ohio.
A. M. Leslie, No. 79 Market street, St. Louis, Mo.
Wm. Cahoon, Detroit, Mich.
E. F. Wilson, Rochester, N. Y.
A. Wilcox, Savannah, Ga.
N. Stebbins, Pittsburg, Pa.
S. S. Blodgett, Ogdensburg, N. Y.
H. Snowden, Baltimore, Md.
S. M. Robinson, Watertown, N. Y.
Jas. Payne, Bloomington, Ill.
Strickland & Robinson, Cleveland, O.
Hall & Kulp, Muscatine, Iowa.

A. W. Alexander, Charlotte, N. C.
Chas. B. Hammond, Laport, Cal.
Miller & Hale, Rockford, Ill.
A. P. Smith, Providence, R. I.
J. P. H. Brown, Atlanta, Ga.

TRAVELING AGENTS.

Geo. F. Foote, Cincinnati, O.
Geo. H. Perine, New York.
C. D. Porter, Bridgeport, Conn.
T. J. Griffin, jr., Providence, R. I.
Abiel Bowen, Batavia, N. Y.

LIST OF LICENSEES

Dr. C. G. Sumner, Norwich, N. Y.
" O. Munson, Washington, D. C.
" E. E. Crofoot, Hartford, Conn.
" J. M. Comegys, Brattleboro, Vt.
" A. A. Morgan, Rochester, N. Y.
810 " Drs. Martin & Woodby, Norfolk, Va.
" Dr. Chas. Merritt, Bridgeport, Conn.
" W. B. Finch, Kingston, N. Y.
" W. W. Allport, Chicago, Ill.
" N. Stebbins, Pittsburg, Pa.
" J. A. Harris, Pontiac, Mich.
" Proctor & Allen, Rochester, N. Y.
" P. H. Austin, Baltimore, Md.
" Wm. R. Hall, Philadelphia, Pa.
" A. Dailey, Washington, D. C.
" Leo Delange, Philadelphia, Pa.
" Wm. M. Wright, Pittsburg, Pa.
" Atkinson & Hallowell, Cleveland, O.
" H. C. Wanzer, Rochester, N. Y.
" A. Blakesley, Utica, N. Y.
" Chas. B. Hammond, Laport, Cal.
" McCall & Turner, Binghamton, N. Y.
" A. W. Kingsley, Elizabeth, N. J.
" Foster & Bennett, Jackson, Mich.
" A. W. Westlake, Rahway, N. J.
" Bardeen & Bro., Hamilton, N. Y.
" Wm. A. Bevin, Boston, Mass.
" S. Martin, Meadville, Pa.
" C. H. Eccleston, Oxford, N. Y.
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" John Mahoney, Richmond, Va.
" G. W. Jones, Richmond, Va.
" C. A. Thompson, Westfield, N. Y.
" Wm. A. Royce, Newburgh and Poughkeepsie, N. Y.
" C. W. Harvey, Buffalo, N. Y.
" Geo. E. Hayes, Buffalo, N. Y.
" Thos. A. White, Detroit, Mich.
" B. F. Whitney, Buffalo, N. Y.
" F. C. Brown, Palmyra, N. Y.
" Wm. B. Van Vleck, Hudson, N. Y.

" Alfred Terry, Norwalk, O.
" Chas. L. Chandler, Syracuse, N. Y.
" Martin Bixby, Plattsburgh, N. Y.
" E. V. N. Harwood, Rutland, Vt.
" J. S. Bridgman, Kendall, N. Y.
" Farley & Hewitt, Union Springs, N. Y.
811 Dr. C. F. E. Blood, New London, Ct.
" H. N. Roberts, Ludlow, Vt.
" Swartly & Shult, Pennsburgh, Pa.
" Isaac Knapp, Fort Wayne, Ind.
" E. E. Duman, Detroit, Mich.
" V. Van Vleck, Hamilton, N. Y.
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" Hawes, Bro. & Seabury, Providence, R. I.
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" Fitz & Fulton, Louisville, Ky.
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" E. S. Eddy, Providence, R. I.
" F. M. Foster, Jackson, Mich.
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" J. B. Beers, San Francisco, Cal.
" D. Vandenburgh, Oswego, N. Y.
" P. G. C. Hunt, Indianapolis, Ind.
" Spencer Roberts, Philadelphia, Pa.
" B. A. Rodrigues, Charleston, S. C.
" Wm. Cahoon, Detroit, Mich.
" W. Ball, Walpole, N. H.
" S. M. Robinson, Watertown, N. Y.
" Jas. Chandler, Syracuse, N. Y.
" D. S. Goldey, Oswego, N. Y.
" J. M. Locke, Boston, Mass.
" G. W. Parmley, New Orleans, La.
" E. F. Wilson, Rochester, N. Y.
" D. S. Nolan, Boston, Mass.
" H. A. Austin, San Francisco, Cal.
" R. G. Snow, Buffalo, N. Y.
" B. S. Brown, Buffalo, N. Y.
" D. D. & A. T. Smith, Syracuse, N. Y.
" Priest & Wells, Utica, N. Y.
" G. A. Foster & Son, Utica, N. Y.
" N. Stevens, Batavia, N. Y.
" White & Weller, Durham, N. Y.
" C. Chatfield, Fairfield, N. Y.
" L. W. Rogers, Utica, N. Y.
" Spencer & Simmons, Providence, R. I.
812 Dr. C. B. Porter, Ann Arbor, Mich.
" E. Salmon, Lima, N. Y.
" A. P. Smedley, Media, Pa.
" Sylvester & Jameson, Lyons, N. Y.
" B. Strickland, Cleveland, Ohio.
" Hallowell & Daniels, Cleveland, Ohio.
" M. J. Dickerson, Cleveland, Ohio.
" Atkinson & Butler, Cleveland, Ohio.

" A. H. Ambler, Cleveland, Ohio.
" B. F. Robinson, Cleveland, Ohio.
" W. P. Horton, Cleveland, Ohio.
" D. C. Ambler, Jacksonville, East Florida.
" O. L. Elliott, Erie, Pa.
" A. Barrett, Ashtabula, Ohio.
" S. Ball, Auburn, N. Y.
" John A. Chase, Geneseo, N. Y.
" J. B. Rawson, Jamestown, N. Y.
" P. B. Bristol, Dansville, N. Y.
" Geo. W. Spencer, Pittsburg, Pa.
" T. A. C. Everett, Randolph, N. Y.
" David Steinburg, New York City.
" Wm. M. Hunter, Cincinnati, Ohio.
" J. A. & H. P. Pelton, Middletown, Conn.
" Bonsell & Smith, Cincinnati, Ohio.
" Jos. Richardson, Cincinnati, Ohio.
" E. D. & A. R. Lord, Bellevue, Ohio.
" A. E. Pursell, Madison, Ind.
" Dills & Gilbert, Peru, Ind.
" L. D. Walters, Lockport, N. Y.
" J. H. Farmer, Detroit, Mich.
" J. Mansfield, Niles, Mich.
" E. E. Dumon, Detroit, Mich.
" Wm. Clelland, Detroit, Mich.
" J. H. Farnsworth, Detroit, Mich.
" R. V. Ashley, Detroit, Mich.
" Whiting & Benedict, Detroit, Mich.
" Job Smyth, Hallsport, N. Y.
" H. D. Bronson, Burlington, Iowa.
" J. A. Robinson, Jackson, Mich.
" E. Honsinger, Chicago, Ill.
" J. A. Perkins, Schenectady, N. Y.
813 Dr. W. M. Martin, Providence, R. I.
" James Taylor, Cincinnati, Ohio.
" C. H. James, Cincinnati, Ohio.
" P. Knowlton, Cincinnati, Ohio.
" C. C. Beilharz, Tiffin, Ohio.
" J. F. Canine, Columbus, Ind.
" M. W. Small, Woonsocket, R. I.
" M. B. Johnson, Janesville, Wis.
" Wm. H. Shattuck, Janesville, Wis.
" Greenleaf & Son, Peoria, Ill.
" Miller & Hale, Rockford, Ill.
" J. A. Scroggs, Galena, Ill.
" J. F. Siddall, Oberlin, Ohio.
" Peebles & Dunham, St. Louis, Mo.
" Aaron Blake, St. Louis, Mo.
" C. W. Spalding, St. Louis, Mo.
" E. L. Green, Louisville, Ky.
" Samuel Mallett, New Haven, Ct.
" T. H. Burras, New York City.
" Hall & Kulp, Muscatine, Iowa.
" E. F. Davis, Galesburg, Ill.
" E. C. Sohn, Galesburg, Ill.
" Robert Dennis, Peoria, Ill.

" C. T. Metcalf, Providence, R. I.
" L. A. Rogers, Grand Rapids, Mich.
" A. W. Alexander, Charlotte, N. C.
" Shirley & Retter, Jacksonville, Ill.
" Charles E. Butts, Belleville, N. Y.
" J. Fleager, Evansville, Ind.
" Jos. Payne, Bloomington, Ill.
" Geo. Paterson, Augusta, Ga.
" W. H. Noble, Mt. Morris, N. Y.
" H. N. Wadsworth, Washington, D. C.
" Ed. Hale, jr., St. Louis, Mo.
" J. W. Burrell & Co., Elyria, Ohio.
" Geo. Watt, Xenia, Ohio.
" S. & C. B. Gallentine, Nunda, N. Y.
" L. W. Bristol, Lockport, N. Y.
" Murphy & Gates, Rome, Ga.
" E. Shower, Nashville, Tenn.
" W. H. Morgan, Nashville, Tenn.
814 Dr. R. Russell, Nashville, Tenn.
" F. J. S. Gorgas, Harrisburg, Pa.
" A. C. Daniels, Brutus, N. Y.
" W. G. Oliver, Buffalo, N. Y.
" Charles O. Hall, Hartford, Conn.
" Duval & Kern, Columbia, Tenn.
" C. W. Brown, Columbia, Tenn.
" J. H. Wayt, Charlotte, N. C.
" J. S. Brewer, Geneva, N. Y.
" Fisher & Deshauer, Chicago, Ill.
" Baker & Bush, Chicago, Ill.
" G. W. Reese, Columbus, Ga.
" A. Hartman, Murfreesboro', Tenn.
" A. L. Wilkinson, Huntsville, Ala.
" N. Chittenden, Madison, Wis.
" L. C. Chisholm, Tuscumbia, Ala.
" A. Rice, Spencerport, N. Y.
" T. M. Henley, Bruington, Va.
" Johnston & Harris, Memphis, Tenn.
" R. B. Coleman, Orionville, Mich.
" E. L. Thurber, La Grange, Tenn.
" J. L. Milton, Grenada, Miss.
" J. B. McClure, Carrollton, Miss.
" Heald & Locke, Portland, Me.
" J. A. Nichols, Lowville, N. Y.
" K. T. Hurlburt, Port Byron.
" J. Smith, Dover, N. H.
" J. D. Harbert, Galesburg, Ill.
" Dennis & Meade, Providence, R. I.
" R. G. Reynolds, Waterbury, Conn.
" A. J. Young, Dover, N. H.
" Pray & Russell, Great Falls, N. H.
" M. S. Eldridge, Providence, R. I.
" B. F. Smith, New Orleans, La.
" Knapp & McLane, New Orleans, La.
" J. S. Clark & Fredericks, New Orleans, La.
" T. J. Hopper, New Orleans, La.
" A. W. Todd, Montgomery, Ala.

" Alfred Martin, Attleboro, Mass.
" Ambrose Lawrence, Lowell, Mass.
" S. L. & W. G. Ward, Lowell, Mass.

815 TO THE DENTAL PROFESSION.

It is well known to the profession that I have, within the last two years, made important improvements in the dental art, for which I have taken out and now own four different patents. One of the most important of them is my compound for bases and gums for artificial teeth, which is so well and favorably known as "amber base." I have used this base extensively in my own practice, but it is only within the last year that I have offered it to the profession generally.

In offering it to the profession I have thought and do honestly think that the preparing and selling my "amber base" is no infringement upon the Goodyear patents, and which fact has been acknowledged by them and their agents; but on learning, however, that the American Hard Rubber Company, owners of the Goodyear patents, were preparing to commence a suit against me for infringement upon their rights, I thought it judicious to take legal counsel in the matter, and after a full and careful examination of all my own and the Goodyear patents, I am advised that my process of vulcanization, as well as the moulds used by me in that process, are covered by the Goodyear patents. I have therefore made arrangements to obtain from them office rights for any part of the United States for those who wish to use my compound. I wish it, however, to be distinctly understood by the profession generally, that my compound is not an infringement; but vulcanizing without a license from the Hard Rubber Company cannot be done without infringing upon their rights.

The price of these rights will be $100, and will protect all such licensees in using and vulcanizing the "amber base," hard rubber, and gutta-percha, and also the flasks patented by Charles Goodyear. I am also prepared to sell any quantity of my "amber base," for cash orders, at the rate of $8 per pound.

I have also for sale my white mineral for filling teeth, and dentists as well as patients, who have tried this, have acknowledged it to be the best of its kind. It is a soft substance, but it hardens in two minutes completely.

It is not affected by the stomach acid, nor by the saliva. It is easily applied in the most difficult cases, not excepting cases where no
816 other filling, not even gold, could be used. It is more durable than metal fillings, and having tried the same during the last three years, I can assure the profession that there is nothing in the market which can compare with the dentine in efficacy. Dentists wishing to try this new dentine in order to convince themselves of its superior qualities will please address G. & F. Dieffenbach, 389 Canal street, New York, who, on receipt of $5 per ounce, will forward it to any part of the United States, with full directions for its use.

G. DIEFFENBACH.

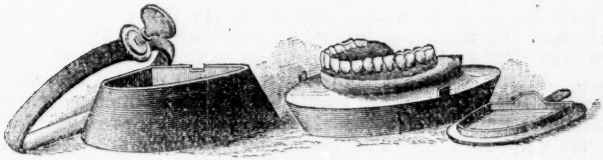
[From the Vulcanite, vol. I, August, 1860, pages 68 to 70; vol. I, November, 1860, pages 130 to 132; vol. I, February, 1861, pages 178 to 180; vol. II, May, 1861, pages 40 to 42.]

Directions for putting up the vulcanite base.

After a thin plaster model is obtained from a perfect impression, adapt

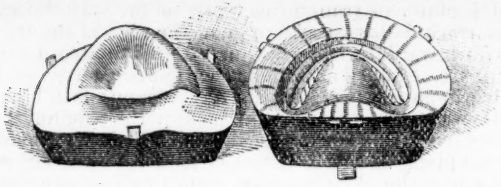
a gutta-percha or wax plate to the model, the size, thickness, and form required. With this get the bite or articulation of the mouth, the same as with a metal plate. Arrange the teeth to the wax the same as for other styles of work, being careful to bend the pins in the teeth to form hooks, either downward, or sideways, or both, as the teeth may require. After the teeth are arranged and the proper expression given, build wax around the teeth, as desired. When the vulcanite is substituted, this process duplicates the wax form in the most perfect manner. The wax should be smoothed with a warm spatula, and a little wax melted around the edge of the plate to fasten it to the model, to prevent any plaster from running under the plate when the upper half of the flask is filled. Some little pains and taste at this stage of the work will save much time in finishing, after the work is vulcanized. The model, with the teeth and wax form upon it, is set, teeth up, in the under side of the flask, and filled with fresh-mixed plaster, even with the edge, or to a line that will admit of a separation, when the remaining half of the flask is put together and filled. Cut 1, with teeth, represents a case in the lower half of the flask, ready for the upper half. We now varnish the plaster
817 with shellac varnish; when dry, oil the varnished surface, then place the upper section in its place, and fill with fresh mixed

Cut 1.



plaster, being careful to fill every part complete, allowing no air-bubbles in the plaster. It is of the utmost importance that the plaster be worked so as to make a homogeneous and solid mass. The cap or top of the flask may now be placed in position, and the clamp or band screwed around the flask. After the plaster has sufficiently set, warm the flask and contents to about blood heat, or a little above, and gently separate; the teeth will be found firmly held in the upper section, with the temporary plate and wax atttached. Now carefully remove the plate and wax, cleaning away all adhering wax from around the teeth, and from between the pins, as seen in cut 2. We now set the upper half, containing the teeth, near the fire, and warm it gently at first, increasing till quite hot. We now cut the rubber into strips of suitable width and length convenient to fill in and around the pins and teeth, and for the plate, and soften them by placing them on a hot brick, or in any other convenient manner. A tin vessel, with a flat cover, containing boiling water, is the best, as there is no danger with it of overheating the rubber. When it is soft and sticky, we commence packing nar-

CUT 2.



row strips around the pins and in the grooves on the anterior side
818 of the base of the teeth, being careful not to allow any plaster or other foreign substances to work into the rubber. Proceed in this manner, adding piece after piece, until the space occupied by the plate and wax is a little more than full. The part of the flask containing the model should be kept cold. The two parts may now be brought together, and a gentle pressure applied. If any blank places are visible on taking the flask apart, more gum may be added. We now cut a series of grooves, one-eighth of an inch in width and depth, from the gum to the outer edge of the plaster, as seen in cut 2. These grooves permit any surplus gum to escape when the flask is screwed together. Some are in the habit of working tin foil on to the model, after melting a thin coating of wax over the surface of the model, or by wetting the surface with any mucilaginous gum, or liquid silex, and carefully rubbing the foil down smooth on to model. After the case is vulcanized, the foil can be dissolved with hydrochloric acid. The foil prevents the plaster from coming in contact with vulcanite and the under surface of the plate, presenting a much more comely appearance. The flask is now to be put together, the two edges being kept as near parallel as possible, the clamp placed on or around the flask, so as to bring it together as even and uniformly as possible. We now gently screw the flask partly down and set it in a warm place for a short time, so as to give the gum time to yield under the pressure, as well as to prevent the teeth from being displaced by a too sudden force, starting the screw at short intervals until the parts come together. As a test for the completion of the vulcanization, twist a little of the gum around the screw outside of the flask; this, in case of any mistake in time, or otherwise, will give the operator a correct idea of the condition of the gum inside, without being under the necessity of opening the flask; if too little done it may be replaced in the heater and vulcanized over. The flask may be placed under water in the heater; one hour at 315, 320, or 325 degrees, is sufficient time to vulcanize the rubber. The degree of heat required to do good work may vary a little in consequence of the variation in the thermometers. The best results, however, are when the vulcanite presents the consistency of horn under the scraping. If too long time is given in vulcanizing, it is more dark in color, and less tenacious. To prevent the gum from working between the joints of the teeth, after the wax is removed, as seen in cut 2,
819 fill the joints with dry plaster, and saturate with liquid silex. To finish the work, use coarse files and scrapers of various shapes and sizes; then fine sand-paper, or emery-cloth, cork wheels, and fine ground pumice-stone and water, cotton wheels or very fine brush wheels, and whiting or prepared chalk and water. The vulcanite rubber is susceptible of a fine and beautiful polish, and the more perfectly it is finished the less likely it will be to retain minute particles upon its surface. The

color of the work may be improved by placing it in a glass vessel under alcohol, and setting it in the *the* sun for a few hours.

The form of partial cases can be changed, after being vulcanized, by covering the surface with sweet oil, and holding it near a fire, or over a spirit-lamp, care being taken not to burn it; when quite hot the vulcanite becomes softened, and very considerable change may be made, and when cold it will retain the shape and position given to it. These changes can be made any number of times without impairing its strength or elasticity.

In cases of misfitting of vulcanite plates, in consequence of wrong impressions, or absorption, or otherwise, take another impression of the mouth, fill for the model, and cut or scrape away the rubber so as to bring the plate reasonably close on to the new model; secure the plate to the model by melting wax along its edge, and set the case and model into the flask, the same as a new one. After the plaster has set, separate the flask; the part containing the teeth and plate is to be heated up until the rubber is quite soft, when it can be removed with ease, and new rubber substituted, saving the articulation complete; the case is then to be vulcanized as at first.

[From the Vulcanite, vol. I, No. 3, November, 1860, pages 99 to 105.]

Communications.

PROVIDENCE, *Sept. 28th*, 1860.

Dr. B. W. FRANKLIN:

DEAR SIR: We have been using your vulcanite base now about a year, and for perfect adaptation, strength, lightness, and the ease with
820 which it is worn by our patients, we think it superior to any other substance used in the mounting of whole sets of artificial teeth. So far the percentage of failures and repairs has been very small indeed.

Very respectfully yours, etc.,

HAWES BRO. & SEABURY.

UTICA, N. Y., *Oct. 8th*, 1860.

Dr. B. W. FRANKLIN:

DEAR SIR: Although I commenced using the vulcanite base with slight misgivings as to its ultimate success, yet the experience of nearly a year has dispelled all doubts, and demonstrated its excellence and real utility. I recommend it with confidence to my patients, as possessing peculiar merit and advantage compared with other styles of work. Its ease of manipulation, compactness, the facility with which it is worn, extreme lightness, and its positive cleanliness, are most important points in its favor. There is no style of artificial work free from objections; this must be included in the same category. But there are fewer objections to it than to any work with which I am acquainted. As regards repairing, I can hardly speak practically, for in thirty-nine different pieces such remarkable success has attended every one that I have not to record a single failure in any particular; consequently no repair. I often use it as an adjunct to continuous gum, inserting a full upper vulcanite, with a full lower continuous gum case, the weight of the latter being of great advantage in many mouths, besides more economical for the patient. Finally, I deem it a mode essential to the complete practice of artificial dentistry, inferior only to continuous gum, fully equal, and in frequent

cases superior, to a gold base. I should not regard my own practice complete without it, nor could I, with my present experiences, possibly do without it.

Yours, truly,

G. A. FOSTER.

UTICA, *Oct. 9th*, 1860.

Dr. G. A. FOSTER:

DEAR SIR: It affords me great pleasure to be able to state, as I now do, in compliance with your wish, my belief in the great superiority of the vulcanite, or vulcanized rubber, for the setting of artificial teeth, over gold or any other substance with which I am acquainted. I
821 have used plates of both the above-mentioned articles of your manufacture, and greatly prefer the vulcanite. It is lighter, and more easily kept clean and sweet, and is entirely destitute of taste or smell.

I am very truly yours,

N. H. DERING, M. D.

BUFFALO, *Oct. 1st*, 1860.

Dr. B. W. FRANKLIN:

DEAR SIR: I will state that I have been using the vulcanite base one year and a half. Fully one-fourth, perhaps one-third, of my artificial work has been mounted on that material. There has been no case of failure or breakage in the work made by myself; and, without attempting to decide its merits as compared with gold plate work skilfully executed, I can say that it is a very important addition to dental resources; one, in fact, which I should not like to dispense with.

Respectfully, etc.,

GEO. E. HAYES.

CARROLLTON, MISS., *Sept. 28th*, 1860.

Dr. B. W. FRANKLIN:

DEAR SIR: I am delighted with the vulcanite or hard rubber base to artificial teeth. Delighted because my patients are all so well pleased with the comfort they enjoy in wearing teeth mounted on the hard rubber base. That last hint you gave me, to vulcanize under water, is a good thing; also, the use of alcohol to bring out the color, I prize most highly. Whenever I can have the time, I keep the piece immersed in alcohol, in the sunshine, two and three days. It matters not how dark, it will bring it out to a beautiful bright gum color. When the patients live at a good distance, and cannot wait, I fill a half-pint bottle with alcohol for them, and direct them how to use it.

Very respectfully,

J. B. McCLURE.

OSWEGO, N. Y., *Oct. 1st*, 1860.

Dr. B. W. FRANKLIN:

DEAR SIR: I use the vulcanite base almost exclusively. I am very much pleased with it. Sets of teeth inserted on it are lighter, stronger, less offensive when being worn, and can be made to fit more ac-
822 curately than any other style of work. By its use the operator is also enabled to give those definite proportions so essential to the beauty and form of the human face.

Very respectfully, yours,

D. S. GOLDEY.

CINCINNATI, O., *Sept. 27th*, 1860.

Dr. B. W. FRANKLIN:

DEAR SIR: I have now been using the vulcanite base with most satisfactory results for over sixteen months, during which time I have put up many cases, all of which (as far as I know) are doing well, and giving entire satisfaction. Those who have formerly worn metallic plates are particularly pleased with the exchange; and there seems to be but one expression among my patients, and that is in favor of the vulcanite. As to failures or repairs, I have never had a failure, or a piece returned on my hands. In the early use of it, I had to rebuild some pieces, from want of experience and bad manipulations. I have never had a breakage or a piece of my own work to repair, excepting for my own mouth, where the pins of a single tooth were deficient, and it had to be replaced by another. I have repaired two other cases of broken teeth without the least difficulty. I have myself worn a partial set for over a year, which fulfills all the uses sought for by an artificial denture, and remains as perfect as when first made. I am in frequent communication with many other dentists in the West using the vulcanite base, most of whom are warm in their expressions in favor of it. Indeed, I hear no complaints except from those who use it without a license, and who consequently use other than the American Hard Rubber Co.'s gums. From my experience as to its practical workings in my own mouth and that of many others, I unhesitatingly give it the preference over all other materials yet known to the profession as a base for dental substitutes.

Respectfully, etc.,

GEO. F. FOOTE.

P. S.—I like the strips you sent me for polishing teeth very much, but would prefer it in lengths suitable for a tape-holder.

GEO. F. FOOTE.

823 NEW YORK, *Oct. 1st*, 1860.

Dr. B. W. FRANKLIN:

DEAR SIR: It is now some two years since I first introduced in my practice the vulcanite, or indurated rubber, as a base for artificial teeth, and can now most confidently say that its adaptability and durability for such purposes are beyond cavilling. I have almost daily opportunities of seeing some of the first cases I introduced, and cannot perceive the least change in the material; and the patients themselves express their preference for this style of base, especially those who have heretofore worn gold and silver plates, with clasps or springs. I am very happy to perceive our manufacturers are giving more attention to the teeth made for this special style and material, and great competition appears to exist as to who makes the best teeth particularly adapted to the vulcanite base.

Respectfully, yours, etc.,

T. H. BURRAS,
48 *Great Jones St.*

BALTIMORE, MD., *Oct. 1st*, 1860.

Dr. B. W. FRANKLIN:

DEAR SIR: You ask me how long I have used the vulcanite, and how it compares with gold. I can make no comparison; certainly none with gold work; a knowledge of it forms the basis of a dentist's mechanical education. The vulcanite requires for its success no such position of

antagonism, possessing, as it does, characteristic merits found in no other work as yet known. I have used it for two years and a half, and cannot in that time detect any material wear or change. Hence, with increasing confidence, I recommend a style of work peculiarly satisfactory to my patients. The work is destined to be very generally adopted. Many will bring discredit upon it, because they will fail to apply to it that skill and accurate manipulation which, more than any work that I know, it requires.

But those who will take the pains to develop the excellencies of the vulcanite will feel, with myself, that to do without it is impossible.

Very respectfully, yours,

P. H. AUSTEN.

824 BLOOMINGTON, ILL., *Sept. 29th*, 1860.

Dr. B. W. FRANKLIN:

DEAR SIR: Your letter of the 24th is received, asking my opinion of the utility of the vulcanite base, compared with other styles of work; also the length of time I have employed it in my practice, the success I have met with, and the percentage of repairs and failures, etc.

1st. In reference to the utility, I have to say that perfect adaptation to the gums, the certainty with which the fit can be obtained, the ease with which the work can be made, the lightness of the work, its superior strength, its elasticity allowing it to yield about as much as the natural teeth yield in their sockets without the least danger of breaking, the absence of all joints and crevices for the retention of food, being equal in this respect to continuous gum, the ease and comfort afforded to persons wearing it by its approximation in feeling to the mouth itself, the total absence of all taste and smell, the trifling expense incurred in doing the work, and, lastly, the impossibility of galvanic action in the mouth which is liable to be produced by metallic plates, thereby decomposing the fluid of the mouth, and thus producing derangement and injurious consequences in the process of digestion, constitute the leading features of its usefulness.

2d. I have used the vulcanite since last March, and have made during that time all varieties of partial and full sets to a large extent, having made partial sets both with and without clasps, and have not yet met with a case in which the rubber was not practicable; and, in fact, I cannot call to mind a case in which it cannot be used with perfect success. I have yet to meet with a failure of any kind, and have the first repair yet to make. I have the testimony of quite a number of very reliable persons who have worn silver, gold, and platina, and their evidence is all greatly in favor of the rubber. I have also had opportunities of seeing nearly all of those for whom I have made this kind of work, and, without a single exception, they express themselves in the most satisfactory terms.

Very respectfully,

J. PAINE.

825 OGDENSBURGH, N. Y., *Oct. 1st*, 1860.

Dr. B. W. FRANKLIN:

DEAR SIR: Yours, asking my written opinion of the vulcanite, is received. I have used the hard rubber for nearly four years, during which time I have made over four hundred plates, and with the greatest success. The percentage of repairs compared with other plates is almost nothing; indeed, I have not had one rubber plate give way. From its

uniform success in my hands, and the universal satisfaction it has given my patients, together with the severe tests to which I have submitted it, I do most unhesitatingly give it as my opinion that it is better adapted for plates than anything else, not excepting gold or platina.

Yours, most truly,

S. S. BLODGETT.

HARTFORD, CT., *Oct. 12th*, 1860.

Dr. B. W. FRANKLIN:

DEAR SIR: In reply to yours of September 24th, asking my opinion in regard to the practical utility of the vulcanite base for artificial teeth, I will say I have used it for two years and a half with great satisfaction, and hesitate not to say, with better success than I ever had with gold or any other material. I have mounted some one hundred and twenty full sets of teeth upon the rubber, and, as far as I know, they have in most cases given entire satisfaction.

"The percentage of repairs compared with gold or other material." I have had but five sets to repair (and these being some of my first cases were probably imperfectly made), which I am sure is a much smaller percentage than would have occurred with gold plates or any other style of work with which I am acquainted. In many cases, where an upper or under set of teeth is needed, I consider the rubber or vulcanite base as possessing advantages which cannot be found in any other known material; and so long as it continues to give the satisfaction to my patrons and myself it now does, I shall continue its use.

Respectfully, yours,

E. E. CROFOOT.

ROCHESTER, N. Y., *Sept. 26th*, 1860.

Dr. B. W. FRANKLIN:

DEAR SIR: I received your letter this forenoon requesting me to
826 give you my opinion of the vulcanite base for artificial teeth. I have not time to say half I would be glad to in its favor, as it has more good qualities than I am able to record on paper. After a practice of more than twenty years in dentistry, I have come to this conclusion, that there is no material used as a base for artificial teeth but we can find more or less objections to, but after using the vulcanite base for three years and a half, I can say without the least hesitation, it has the least objection of any. While it may have imperfections, it has many qualities that far outshine all other kinds of work—to the operator a great saving of hard labor, and to the patient a very great increase of comfort. For the last two years I have not made more than one or two metal plates, but have taken, in exchange for rubber sets, any quality of gold plates, and have made over most of the continuous gum sets that I have made heretofore, with the most satisfactory results. The expense of keeping it in repair is not one-fourth that of other work. I fully believe in a few years more (in this region of country) it will be as difficult to find a metallic plate in the mouth as it was four years since to find one of hard rubber. I am well aware that, like other kinds of work, it will in some cases fall into the hands of inexperienced operators and be called a failure, but when it fails in the hands of one who understands fully the science of putting it up, I shall think it time to find something better.

Yours, in haste,

E. F. WILSON.

CINCINNATI, O., *Sept. 27th*, 1860.

Dr. B. W. FRANKLIN:

DEAR SIR: Doubts are often expressed about the possibility of repairing the vulcanite base. I have succeeded to my entire satisfaction in replacing teeth that have been fractured by the following plan, viz: Remove the fragments of the tooth with care so as not to deface the base; grind and fit in another tooth, and, if possible, give it a bearing against some point; bend the pins short and give ample space for them with a drill, and with a drill make small lateral holes into the base to give the new gum anchorage; scrape and thoroughly clean the part to be covered with new gum; apply the gum in abundance, and, after heating the tooth, press it home to its bearing. The gum readily yields to the hot tooth, which can be adjusted and held in position for a
827 few moments until the parts are sufficiently cooled to hold it inside, when the whole should be enveloped in plaster and vulcanized; after which remove the surplus gum, polish, and bleach in the sun.

Respectfully, yours,

GEO. F. FOOTE.

[From the Vulcanite, vol. II, November, 1861, page 142.]

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[From Harris's Principles and Practice of Dental Surgery, fifth edition, 1853, chapter XIX, pages 736 to 740.]

Artificial teeth secured in a base of tin.

Tin has been occasionally employed as a base for artificial teeth, by a few dentists, since 1849, and Dr. Willam A. Royce, dentist, of Newburg, New York, used it in one case as early as 1836.* The author has had no experience in the use of tin for this purpose, but from a set of teeth for the lower jaw which he saw in 1850, put up by Dr. G. E. Hawes, of New York, he believes it may be employed in many cases with advantage. In supplying the loss of the natural teeth in the inferior maxillary, with an artificial substitute, the stability and usefulness of the piece often depends, in a considerable degree, upon its weight, and if the employment of tin as a base for artificial teeth is admissible under any circumstances it is in cases of this sort; when used in sufficient quantity it affords as secure a support for artificial teeth as a plate of gold of the thickness ordinarily employed, and when properly covered with gold can impart no unpleasant taste.

829 Dr. E. G. Hawes, to whom we are indebted for nearly all the information we possess upon the subject, says in vol. i, No. 1, new series American Journal of Dental Science, "from extensive experiments and inquiry, notwithstanding the objections urged against it, I am still of opinion that pure tin gilded, or without gilding upon a thin gold plate, may be used in all cases of whole or fractional under sets of artificial teeth, with more comfort and advantage to the patient, and with less expense and labor to the operator, than is possible with the use of gold alone." The article from which this quotation is made was published in October, 1850; and in a letter addressed to the author in October, 1852, he says, "I have, as yet, no occasion to change my views in regard to the value of pure tin as a base for lower sets of teeth, when weight is the desideratum." Dr. Royce has employed tin in connection with gold plates, for upper as well as lower sets of teeth; but for the former, the use of it must be regarded as objectionable, as it would unnecessarily increase the weight and bulk of the piece, and render it more cumbersome to the mouth.

When tin is used for a fractional set of teeth for the lower jaw—as, for example, for the molars and bicuspids of both sides—a thin plate of gold should also be employed. This is first struck up in the usual way, strengthening that part which passes behind the incisors and cuspidati, by soldering to it another piece of plate or broad half-round wire. The

*Vide American Journal of Dental Science, vol. i, No. 1, New Series.

plate being properly adjusted, wax is placed on it, and cut to the proper curve and height. The teeth are then selected, arranged upon the wax, and antagonized, leaving a space between them and the plate to be filled with tin. A thick batter of plaster and sand is now placed on the outside of the teeth. When this is dry, the wax is taken off, the teeth removed, one at a time, and a thick backing of gold put on each, bending the platina pins over the gold. The backings may be soldered to the plate in the usual way, or with tin and the soldering-iron. In the latter case, a sufficient quantity of tin should be applied to cover the backings and platina pins, imitating, as nearly as practicable, the original shape of the inside of the alveolar border. This done, the plaster is removed, and a sufficient quantity of tin applied on the outside to fill the spaces between the teeth and the plate, and to restore the loss occasioned by the destruction of the alveolar ridge. The tin is melted
830 and made to flow to the proper place with a soldering-iron. This is afterwards trimmed, burnished, and a coating of gold applied by means of the electro-galvanic process.

For a whole lower set, the base may be cast. In this case, metallic castings and plates are dispensed with. The following is the method of procedure recommended by Dr. Hawes:

First procure a cast from a wax or other impression in the usual way, made of plaster, having a large proportion of sand incorporated with it. To this, as thick a plate of tin as can be accurately fitted to it with a burnisher is adjusted and trimmed to the proper size. Wax is then placed upon it, and the teeth selected, arranged, and antagonized in the manner as directed in another chapter, leaving space between them and the plate of about the sixteenth of an inch. Backings to the teeth are not required, but the platina pins should be made to diverge, and the ends of the teeth next to the plate broken or ground off. The teeth when arranged upon the plate will present an appearance something like that represented in Fig. 206.

FIG. 206.

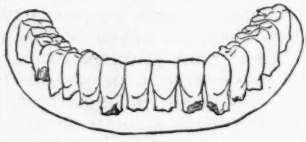
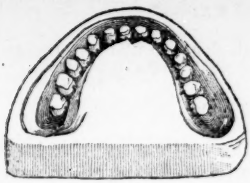
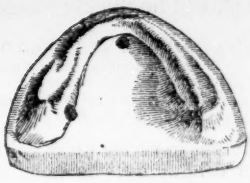


FIG. 207.

Having proceeded thus far, wax is placed around the lower part of the teeth and between them and the plate, imbedding the ragged fractured extremities of the former in it. It is now carved to represent the shape of the gums, giving it the proper fulness, as seen in Fig. 207, which appearance the piece will have when finished. The platina pins should be so low in the teeth as to be covered by the wax after the carving is completed. Teeth made expressly for the purpose would be preferable to those commonly employed. When the process of carving the wax is completed, oil the plaster model or cast, then place the teeth and wax upon it and cover them thickly with a batter of plaster and sand. When the plaster has become dry or has thoroughly consolidated, separate the mould, and remove the tin plate and wax, leaving the teeth partially imbedded and secured in the upper part of the matrix,
831 with the parts covered with the wax only exposed, as shown in Fig. 208.

FIG. 208. FIG. 209.





Several holes are now made through one part of the mould at such points as will not interfere with the finishing of the work, for the introduction of the melted tin and for the escape of the air. The mould or matrix thus prepared is represented in Fig. 209, with the two parts put together.

A flux of muriate of zinc is now applied to the platina pins, the matrix closed and bound firmly together with iron wire; it is then heated to a temperature equal to that of melted tin. Pure tin, melted, but not having a temperature very much above the melting point, is now poured into the mould through the holes prepared for its reception. After it has cooled sufficiently, the matrix may be separated, and the asperities of the tin removed with a file. Every part of the surface of the base may then be rubbed with sand-paper, and afterwards finely polished. The same neatness of finish is required as when the base is made of gold. When gum teeth are employed the tin can only be cast on the inside and beneath the teeth.

Before gilding, the piece should be worn a few days to ascertain if the adjustment is perfect, as any future alteration would deface the base and render a second coating of gold necessary. The adaptation being correct, the tin should be thoroughly cleansed for the removal of all grease and other foreign matter. This should be done first with alkaline solutions, and afterwards with water. It should now be freed from moisture and thoroughly polished with prepared chalk and a soft brush. This done, wash in water for the removal of all extraneous matter, and then place the piece in a "gilding solution." Dr. Hawes directs that during this process "the teeth should be removed two or three times and burnished, both to give solidity to the deposit" and to remedy any imperfections that may be discovered. The piece is finished,
832 after a sufficiently thick coating of gold has been deposited on the tin base, with a burnisher. Unless care is used in gilding, the gold will be removed from the tin in burnishing. From two to five dwts. of gold may be deposited upon a single base.

So far as the taste of the metal is concerned, Dr. C. O. Crosby, dentist, of New Haven, is of the opinion, from experiments which he has made, that pure tin is less objectionable, without a covering of gold, than eighteen-carat gold, in connection with solder composed of copper, silver, and gold. He also states that he has never found a person who could not wear teeth with a tin base. But from our knowledge of the

properties of tin, we would think that when a base of this metal is employed, it should be thickly plated with gold.*

[From Harris's Dictionary of Medical Terminology, Dental Surgery, and the Collateral Sciences, second edition, 1855, pages 343, 344.]

Gutta-percha.

The concrete juice of a tree belonging to the natural order Sapotaceæ, a native of Singapore. It is of a grayish white color, and below the temperature of fifty degrees is of the hardness of wood, but when put in boiling water it becomes very soft and pliable. In this state it may be moulded into any form, which it will retain on cooling. It is used in making bougies, catheters, enema-pipes, splints, and for taking
833 impressions of the mouth. It has also been used in combination with other substances as a temporary filling for teeth, and as a base for artificial teeth.

[From the great exhibition of the works of industry of all nations, 1851. Official descriptive and illustrated catalogue, page 474.]

720. Truman, E., 40 a, Haymarket, inventor.

Patent artificial teeth with gutta-percha gums. Set of mineral teeth mounted in gutta-percha. Small case, intended to illustrate a further application of the principle.

Specimens of pure gutta-percha, such as used in the preceding articles, before the coloring process.

[From reports of the juries, exhibition of 1851, page 598.

Quite recently, by the exertions of Mr. Truman, a lump of colored gutta-percha, moulded into the form of a jaw-bone, has been found capable of holding together artificial teeth, and thus advantageously superseding those settings in gold which were so costly, and the absolute rigidity of which, moreover, presented much inconvenience. The slight but sensible elasticity possessed by gutta-percha renders it, on the contrary, very well adapted to this use.

[From the American Journal of Dental Science, Vol. II, new series, January, 1852, pages 332 and 333.]

Gutta-percha as a base for artificial teeth.

We have received a communication from Robert Parsons, surgeon dentist, of York, England, informing us that a Mr. Turner had ob-
834 tained a patent for "fixing artificial teeth upon a preparation of gutta-percha." He also states that he has a set in his possession the entire base of which is composed of the same material, which had

*It may be inferred from our remarks at the commencement of this chapter, that Dr. Royce was the first to employ tin as a base for artificial teeth. It has occurred to us since writing it that there is a set of artificial teeth for the lower jaw in the museum of the Baltimore College of Dental Surgery, mounted on a base of this description, which were made some time previously to 1820, by the late Dr. Edward Hudson, of Philadelphia. They were presented to the author, for the above-named institution, by Dr. E. Townsend, of Philadelphia. The piece, from the decayed condition of the teeth, which are crowns of human teeth, must have been worn a number of years, and yet the base was not affected by the action of the secretions of the mouth.

been worn for some time, and made by his brother, Mr. J. H. Parsons, dentist, of Halifax, who had made others during his residence at Liverpool. He does not, however, regard this material as suitable for the purpose, and says, "it can never supersede well-adapted gold plates, or carefully sea-horse ivory foundations."

Some six or eight months previously to the receipt of the communication here referred to, we received a letter from a professional gentleman residing in New England, who informed us that he had succeeded in making a preparation of gutta-percha which he had used as a base for artificial teeth. He also informed us that in the cases in which he had used it, it had fully realized his most sanguine expectations, promising that after he should have tested it sufficiently, and if it should prove to be really valuable for this purpose, to make the discovery known to the profession. He moreover sent us a small piece of the preparation, and we believe he is still engaged in trying to improve it. We hope he will soon give us an opportunity of laying the results of his experiments before the profession.

[From Comtes-rendus hebdomadairies des séances de l'Académie des sciences, Juillet 13, 1835, tome trente-troisième, Juillet-Décembre, 1851, page 126.

M. Delabarre fils soumet au jugement de l'Académie un Mémoir sur l'emploi de la gutta-percha dans la frabrication des dentures artificielles:

"Dans les dentures artificielles, la partie qui représente l'arcade alvéolaire se peut faire des substances très-diverses, mais dont aucune n'est exempte d'inconvénients. Si l'on a recours au métal, tout l'appareil est pesant, et ce n'est qu'après beaucoup de tâtonnements qu'on peut lui donner une forme qui s'accommode bien aux irrégularités du bord gengival de manière à exercer partout une égale pression. Si l'on emploie des pâtes plus ou moins analogues à la pâte de porcelaine, ou a moins de difficulté, il est vrai, sous le rapport du modelé des surfaces destinées à être mises en contact avec les gencives; mais il reste l'inconvénient du poids, auquel peut s'ajouter celui du volume, puis qu'avec des parties très minces l'appareil manquerait de la solidité nécessaire. A-t-on recours à des substances empruntées au règne animal, telles que l'ivoire, les dents d'hippopotame les défences de morse, on peut avoir des appareils légers sans être fragiles; mais le travail du modelé reste toujours difficile, et, ce qui est un bien plus grand inconvénient, les substances sont attaquées par la salive ou par les liquides qui traversent la bouche; leur surface, au bout de quelque temps, devient rugueuse, et irrite le bord gengival, elles prennent aussi, malgré tous les soins de propreté, une odeur déplaisante qu'elles communiquent à l'haleine.

"La gutta-percha est exempte de ce défaut, et les expériences auxquelles on l'a soumise montrent qu'après une assez longue immersion dans des liquides plus actifs que ceux avec lesquels elle peut se trouver momentanément en contact dans la bouche elle n'a éprouvé aucune altération. Chauffée au bain-marie à une température de 100 degrés, elle devient assez molle pour donner la contre-épreuve exacte d'une sorte de matrice dans laquelle on l'a fait entrer au moyen d'une pression convenablement exercée; cette matrice, qui s'obtient au moyen d'un double moulage au plâtre, représente très-exactment le bord alvéolaire. On fixe dans l'arcade ainsi préparée, et au moyen de crampons métalliques appliqués à chaud, soit des dents naturelles, soit des dents en pâte. Ajoutons que la gutta-percha, avant d'être moulée et pendant qu'elle est dans l'état de mollesse, a été colorée de manière à imiter la teinte des gencives, et que cette couleur est durable."

(Translation.)

Mons. Delabarre, jr., submits to the judgment of the academy an article on the employment of gutta-percha in the manufacture of sets of artificial teeth:

"In sets of artificial teeth, the part which represents the alveolar arch can be made of very different substances, but of which none are exempt from inconveniences. If one has recourse to metal the whole apparatus is heavy, and it is only after repeated attempts that one can give to it the form which accommodates itself well to the irregularities of the edge of the gum in a manner to exercise an equal pressure on all parts.

836 "If one employs paste, more or less analogous to porcelain paste, one has less difficulty, it is true, with respect to the modeling of the surfaces destined to be put in contact with the gums, but there remains the inconvenience of weight, to which may be added that of bulk, since, with very slight parts, the apparatus would lack the necessary solidity.

"Has one recourse to substances borrowed from the animal kingdom, such as ivory, the teeth of the hippopotamus, the tusks of the morse, one can have apparatus light without being tragile; but the work of modeling still remains difficult, and, what is a much greater inconvenience, the substances are attacked by the saliva or by the liquids which pass through the mouth; their surface, at the end of some time, becomes rough, and irritates the edge of the gums; they take also, in spite of all cares of cleanliness, a displeasing odor, which they communicate to the breath.

"Gutta-percha is exempt from this fault, and the experiments to which one has submitted it show that after a sufficiently long immersion in liquids more active than those with which it can find itself momentarily in contact in the mouth, it has experienced no alteration. Warmed in a wet bath to a temperature of 100 degrees, it becomes soft enough to give the exact counter-proof of a kind of matrice in which one has made it enter by means of a pressure suitably exercised. This matrice, which is obtained by means of a double casting in plaster, represents very exactly the alveolar edge. One fixes in the arch thus prepared, and by means of staples applied hot, either natural teeth or porcelain teeth. Let us add that the gutta-percha before being moulded, and while it is still in a state of softness, has been colored in a manner to imitate the tint of the gums, and that this color is durable."

[From the New York Dental Recorder, Vol. III, No. 4, January, 1849, page 80.]

Employment of gutta-percha for artificial palate.

A correspondent says:

"I have found the substance, gutta-percha, suitable for making artificial palates, very easily moulded on a cast of the
837 mouth into the necessary shape, and retaining its firmness and smoothness unimpaired by the temperature to which it is there subjected. Kneaded out into a smooth sheet, about the thickness of a sixpence or a shilling, and pressed into the proper form—the edges accurately following the sinuosities of the teeth, and a hooked process or two of the same material adjusted in the usual way—it will be found to answer very well, being smooth, light, and firm. If required, a slight rim of gold, fitted to a few of the teeth, may be fixed to the edge of the gutta-percha. If care be used to mould the material equally and

smoothly it will be more agreable in the mouth than a metallic body. When the Schneiderian membrane is too tender to permit the use of the sponge and plate, a period with some patients of long duration, this simple, cheap, and effective instrument will be found valuable. It may supersede the use of the soft crumb of bread, soaked dossils of soft lint, etc., which are used as temporary expedients to close the orifice in cases where bones are coming or have recently come away; but even when the membrane has become firm, a palate of this material—with or without a piece of prepared caoutchouc adherent to the upper part of the gutta-percha, so as to press into the exact shape of the orifice, and form a sort of air-tight valve—will be as agreeable to most patients as the instrument commonly employed.

"Its advantages are its cheapness, lightness, and absence of unpleasant taste or feeling. For poor patients, who are usually prevented, by the expense of gold or platinum plates, from obtaining relief, I hope gutta percha will be made available.

"In cases of congenital deficiency, fissure of palate, etc., I think considerable relief might be afforded by attaching to a hard palate of the gutta-percha an artificial soft one of prepared caoutchouc. The caoutchouc adheres easily and permanently to the warm gutta-percha, and if properly prepared, and of a suitable flexibility, thickness, and shape, it might, I should think, very materially aid the great numbers of persons who suffer from this distressing deformity. The expense, at any rate, need not henceforth prevent any one from seeking relief.

838 The soft palate I have not tried; for an artificial hard one I have found the gutta-percha practically useful. Whether it may resist the action of the fluids of the mouth for any length of time remains to be seen. If so, I cannot see any objection to the employment of this substance for the purpose named. In the hope that it will be fully tested, and that it may, perhaps, relieve some suffering, I offer the hint to the professional public through your columns."—LONDON LANCET.

[From the New York Dental Recorder, Vol. IV, September, 1850, pages 286, 287, 288.]

[From the Dental Register of the West, Vol. IV, October, 1850, pages 38, 39, 40.]

Improvement in the method of mounting artificial teeth.

For several years past a few dentists among our acquaintance have been in the practice of soldering their artificial teeth, for entire lower sets, to the gold plates with pure tin, using the tinman's soldering-iron instead of the blow-pipe. The manner of proceeding is as follows:

First strike up, in the usual manner, a very thin gold plate (No. 30 or 31 will answer) to fit the jaw. When this is done, place the wax upon it and cut it to the right curve and the proper height for the length of the teeth. The teeth are then to be selected and put round upon the wax in the proper position for use; but it does not matter whether or not they come down to the plate, provided all that part of them which is exposed to view when in the mouth is right, as all below will be filled with tin when the process is completed. Plaster and sand is now to be put on the outside of the teeth and plate, in the same manner as though they were to be soldered in the usual way. When this is done the wax may be cut away, the teeth removed from the plaster, and a thin gold back put upon them. In backing them it will be necessary to bend the platina wires together, over the gold, with a common pair of pliers. The backs may now be soldered to the plate, forming one solid

mass of tin as high as the wires, and imitating, as nearly as possible, the form of alveolus which has been absorbed. When this is
839 done the plaster may be taken away, and as much tin put upon the front as will restore what has been lost by absorption of gum and alveolar process.

When the piece is properly trimmed and burnished it makes a very strong and natural set of teeth, while the additional weight given to it by the tin keeps it in place better than those made in the ordinary way. Some use silver plate instead of gold, and gild the whole by the galvanic process, and we can see no reason why this metal should not answer just as well as gold. We have put in several temporary sets in the above manner on gold, and all have done remarkably well, giving entire satisfaction. This plan of mounting teeth was first practiced, we believe, by Mr. Royce, about eight years since, and has been used by him in very many cases, as he alleges, with perfect success.

Mr. Georges E. Hawes has lately made an improvement upon the above plan, by means of which he dispenses with all metallic castings and plates of every kind, using only the pure tin and the teeth. His plan is, after the first cast is procured, which should be made of plaster with a large proportion of sand to fit to it a piece of tin foil, or plate, as thick as can well be rubbed down to it with a burnisher, and as large as a gold-plate would have to be. The wax is then put upon this tin-plate and trimmed to the proper curve and height as in ordinary practice. Next, the teeth are to be placed upon the wax, and when properly arranged a strip of wax is put around the bottom of the front side of the teeth and plate. This wax, and that on the backs of the teeth, is then to be carved to represent the natural gums or so as to form a smooth ridge as high as is desirable. Care must be taken to select such teeth as have their platina pins low, so that they may remain imbedded in the wax.

When this process is completed, the whole is to be placed upon the plaster and sand-cast, and more plaster and sand poured over it, so as to cover with a thick mass the whole of the wax and the teeth. After the plaster has thoroughly hardened the casts may be parted, and the tin-plate and all the wax taken away, and the platina wires and those parts of the teeth exposed washed with muriate of tin. A hole to pour the melted tin into must now be made at one end of the set, and another on the other side for the air to escape from. When completed thus far it is ready for the pouring, and to insure perfect suc-
840 cess the castings should be securely bound together and the whole mass heated to the temperature of melted tin.

Sets of teeth made in this way and having the casting thoroughly gilded are much handsomer and more natural in their form than those which have the long teeth and gold backs; they are also stronger, as they are protected both front and back, can be made for one-half the expense of the ordinary sets on heavy gold plates, and judging from the little experience which we have had in making and testing them, as well as the testimony of Mr. Hawes, are equal in every respect, if not superior, to those mounted upon gold backs.

[From the Revue Odontotechnique, Vol. Ier, No. 6, Juin 1860, pages 160, 161, and 162.]

Système à base de caoutchouc. Par le Docteur B. W. Franklin, de New York.

On ne peut nier que le système à base de caoutchouc ne se soit acquis aujourd'hui une réputation et une popularité sans égales dans l'histoire des inventions et des perfectionnements de l'art dentaire.

Mais tout système, si compliqué ou si simple q'il soit dans ses détails et son exécution mécanique, dépend néanmoins de certaines lois fixes, pour obtenir des résultats parfaits et uniformes. Plus un système offre de facilités pour son exécution, plus l'opérateur sera porté à négliger quelques détails, insignifiants en apparence, et qui pourtant expliquent l'insuccès.

Toute opération de l'art dentaire exige de l'habileté, de l'expérience et de l'application, et si tous ceux qui exercent cet art possédaient ces qualités, ce n'est pas trop de dire que le public nous en serait reconnaissant.

Le soins qu'ont apportés d'habiles praticiens dans la fabrication de leurs pièces, produisant ainsi des appareils s'appliquant parfaitement à la bouche, et la facilitè et le plaisir même avec lesquels ces pièces se portent sont en partie cause de la popularité dont jouit adjourd'hui le système à base de vulcanite. Lorsque cette matière est de bonne qualité, elle est susceptible d'un beau poli très durable, et pos-
841 sède plus de résistance que toute autre substance employée jusqu'à ce jour comme base de pièces dentaires, ainsi que nous en avons journellement les preuves.

Les personnes qui n'ont pas une longue expérience de la vulcanite peuvent demander si elle est bien durable et si elle est applicable aux pièces partielles.

En réponse à la première de ces questions nous dirons qu'il y a dans cette ville des personnes qui en portent constamment depuis plus de cinq ans sans s'être aperçu d'un changement quelconque, et les dentistes qui les premiers se sont servi de ce système ont complétement renoncé aux autres.

Pour les pièces partielles, il est infiniment supérieur à tout autre, puisqu'il permet les petits crochets qui entourent les dents naturelles sans produire aucun effet nuisible, tel que le frottement et l'action galvanique causés par tous les métaux, même par l'or le plus pur.

La demi élasticité que possède le caoutchouc, même durci, permet qu'un appareil de plusieurs dents puisse parfaitement se tenir par la simple pression de deux petits points sur deux dents naturelles.

Enfin la vulcanite est admirablement adaptée pour pièces régularisatrices: bref il n'y a aucun doute que cette invention ne soit la plus belle qui ait jamais été présentée à la profession.

Si maintenant on objecte qu'une matière si facile à exécution est appelée à faire baisser les prix des opérations dentaires, nous répondrons que si cela est un mal, la profession seule en est responsable et non les inventeurs, ni ceux à qui ces inventions appartiennent aujourd'hui.

Nous avons donné place dans nos colonnes à cet article, non parce que nous lui avons trouvé un grand mérite d'originalité, mais pour faire remarquer que l'auteur de cet article est aujourd'hui un avocat plus zélé de la vulcanite qu'il ne l'a été pendant les deux années que nous le présentions en Amérique alors qu'il s'opposait à ce système. Nous ne nous arrogeons pas le mérite de l'avoir converti, mais nous sommes enchanté du zèle qu'il déploie, et nous ne doutons pas que, grâce à son talent réel, il ne parvienne à appuyer encore plus cette invention qu'il n'a cherché d'abord à l'entraver.

842 (Translation.)

It cannot be denied that the system of rubber base has acquired today a reputation and a popularity without equal in the history of the inventions in and perfecting of the dental art.

But every system, no matter how complicated or simple it may be in its details or mechanical execution, depends, nevertheless, upon certain fixed laws to obtain perfect and uniform results. The more a system offers facilities for its execution, the more the operator will be brought to neglect some details, insignificant in appearance—which, however, explain the ill success.

Every operation of the dental art requires ability, experience and application, and if all those who exercise this art possessed these qualities, it is not too much to say that the public would thank us for it.

The care which some able practitioners have used in the manufacture of their pieces, producing thus fittings adapting themselves perfectly to the mouth, and the ease and the pleasure even with which these pieces are worn, are in part a cause of the popularity which the system of the vulcanite base enjoys to-day. When this material is of good quality it is susceptible of a very fine durable polish, and possesses more resistance than any other substance employed up to this day as a base for dental pieces, as we have daily proof of it.

Persons who have not a long experience with vulcanite may ask if it is very durable, and if it is applicable to partial pieces.

In answer to the first of these questions, we will say that there are in this city people who have constantly worn them for five years without having perceived any change whatever, and the dentists who have first availed themselves of this system have completely renounced others.

For partial pieces it is infinitely superior to every other, since it admits of the little (metal) ties which compass around the natural teeth without producing any hurtful effect, such as rubbing and the galvanic action caused by all metals, even by the purest gold.

The semi-elasticity which rubber possesses, even when hardened, allows a fitting of several teeth to be perfectly held in the mouth by the simple pressure of two small points on two natural teeth.

843 Finally, vulcanite is admirably adapted for regulating pieces: in short, there is no doubt that this invention is the most beautiful which has ever been presented to the profession.

If now it is objected that a material so easy of manipulation is resorted to to make the prices of dental operations lower, we shall answer that if that is an evil, the profession alone is responsible for it, and not the inventors, nor those to whom these inventions belong to-day.

We have given place in our columns to this article, not because we have found any great merit of originality in it, but in order to remark that the author of this article is to-day a more zealous advocate of vulcanite than he was during the two years that we were presenting it in America when he was opposed to this system. We do not take upon ourselves the merit of having converted him, but we are charmed with the zeal which he displays, and we doubt not, thanks to his real talent, he will yet succeed in supporting this invention more strongly than he at first sought to trammel it.

[From the Revue Odontotechnique, Vol. Ier, No. 11, novembre, 1860, pages 297, 298, 299, and 300.]

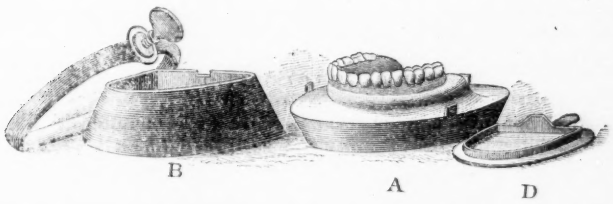
Base de caoutchouc—Système Putnam. Maniere de confectionner les dentiers et pièces artificielles par ce système.

PREPARATION.

Après avoir fixé sur un modèle obtenu d'une bonne empreinte une

mince feuille de papier d'étain, on couvre la surface du modèle d'une plaque de gutta-percha, on lui donne la forme propre, et c'est avec cette plaque que l'on prend l'articulation par les moyens connus. On entoure alors cette même plaque, que l'on a replacée sur le modèle, de cire molle, et l'on arrange sur cette même cire les dents dont on a plié chaque pointe en sens inverse. On modèle alors, on adoucit, en un mot on fait avec la gutta-percha et la cire la pièce telle qu'on veut l'avoir en caoutchouc, en lui donnant toutefois un peu plus d'épaisseur, afin
844 de permettre la réduction que fera le grattage. Lorsque cette opération est terminée, on place le modèle avec la pièce qui le recouvre, les dents en haut, dans la partie inférieure du moufle que l'on vient de remplir de plâtre fraîchement gâché.

Fig. 1.



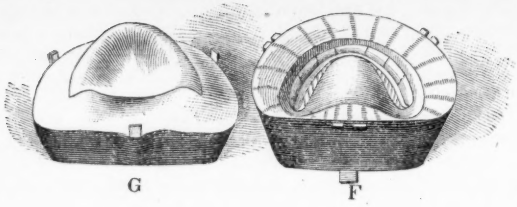
Dans la figure 1, la pièce A représente la partie inférieure du moufle remplie de plâtre et supportant le modèle ainsi que la pièce en cire. Le plâtre est soigneusement huilé; on place sur la base A la partie supérieure B, on coule dans cette même partie et sur la pièce même du plâtre, ayant soin d'éviter les bulles d'air. On fixe alors sur la partie B le couvercle D, dans lequel on a mis aussi une petite quantité de plâtre. On place alors l'anneau C et l'on en serre la vis de telle sorte que les trois parties du moufle soient parfaitement retenues les unes sur les autres.

Lorsque le plâtre est suffisamment dur, on chauffe légèrement le moufle et l'on sépare la partie A de la partie B; les dents se trouvent alors fermement retenues dans la partie supérieure, ainsi que la cire et la plaque de gutta percha. On enlève avec soin ces deux matières. La partie supérieure F (Fig. 2) se trouve alors prête à recevoir le caoutchouc que l'on a coupé par petites bandes et que l'on a fait ramollir sur une chaufferette ou autre petit appareil pouvant contenir de l'eau chaude. On tasse le caoutchouc dans la cavité, en ayant soin d'empêcher l'accès de l'air ou de l'humidité.

Il faudra autant que possible mettre une quantité assez grande de caoutchouc, plutôt plus que moins, l'excédant devant s'échapper plus tard et pendant la vulcanisation par les rainures que l'on a faites sur la surface du plâtre et que l'on voit dans la Fig. 2, F.

On place alors une feuille de papier d'étain sur la partie qui représente la bouche sur la pièce G, ayant passé préalablement une mince couche de gomme quelconque liquide, afin de la faire bien adhérer, et on
845 le lisse avec une boule de coton légèrement imprégnée d'huile. On replace alors la partie G sur la partie F. On remet le cercle et l'on serre. On fait chauffer le moufle de telle sorte que le caoutchouc

FIG. 2.

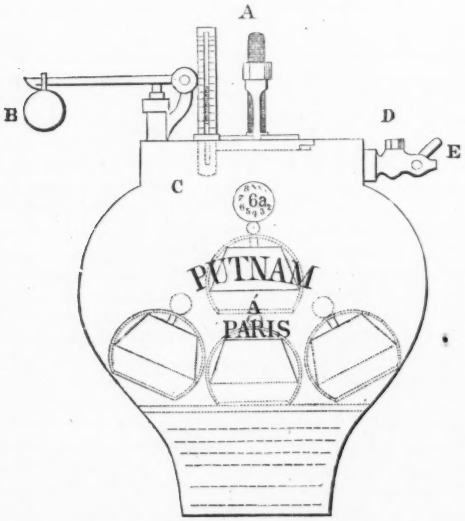


qu'il contient devienne tout à fait mou. On resserre de nouveau jusqu'à ce qu'il n'y ait plus d'intervalle entre la partie inférieure et la partie supérieure. De cette manière on ne court aucun risque de briser les modèles ou de déplacer les dents.

DE LA VULCANIZATION.

L'appareil dont nous nous servons peut être chauffé de n'importe

FIG. 3.



quelle manière; la vulcanization s'opère par la chaleur de la vapeur.

846 Il est construit de telle sorte que l'eau ne doit jamais être renouvelée pendant l'opération; il ne doit contenir qu'une minime quantité d'eau, c'st-à-dire jusqu'à la grille sur laquelle on place les moufles qui contiennent les pièces à vulcaniser. On ajuste alors le couvercle de l'appareil, on serre la vis de pression A, on place le poids B sur le levier de la soupape de sûreté, on place le thermomètre dans la capacite C

dans laquelle on a eu soin de mettre une certaine quantité de mercure, de telle sorte que le réservoir du thermomèter soit toujours entouré du métal liquide. Au tourillon D, fixé, sur le robinet de dégagement E, on peut fixer le manomètre si on le désire.

Il faudrait toujours avant de commencer la vulcanisation nettoyer la petite pièce de la soupape et le robinet avec un peu d'huile ordinaire, afin d'éviter toute fuite de vapeur.

Lorsque l'on a placé ces moufles dans l'appareil et préparé ce dernier comme il a été dit plus haut, on chauffe graduellement jusqu'à ce que le thermomètre marque 155 degrés centigrades, ou le manomètre, si l'on emploie ce dernier, 5 atmosphères et demie. On conserve le même degré de chaleur pendant une heure un quart ou une heure et demie, ou plus longtemps, selon le degré de dureté que l'on veut obtenir. On dégage alors la vapeur, on défait le couvercle, on retire les moufles et on les met dans l'eau froide jusqu'à ce qu'ils soient parfaitement refroidis.

MOYEN DE TERMINER ET DE POLIR LES PIÈCES EN CAOUTCHOUC.

On se sert en premier lieu de la râpe pour enlever à la pièce toutes ses parties superflues et lui donner la forme que l'on désire; puis l'on gratte à l'aide d'instruments de différentes formes. On se sert alors des papiers à émeri de différentes grosseurs, puis l'on polit à l'aide de la pierre ponce et de l'eau. On donne le dernier brillant à l'aide du tripoli ou du blanc d'Espagne.

La manière la plus prompte de polir est celle d'employer la brosse circulaire montée sur le tour. Il faut avoir soin de ne point toucher ni avec la lime ni les échoppes à la partie de la pièce qui doit se trouver en contact avec le palais ou les gencives.

Il sera facile d'en faire disparaître le papier d'étain à l'aide d'un peu d'acide muriatique ou d'acide nitrique.

847 (Translation.)

PREPARATION.

After having fixed upon a model, obtained by a good impression, a thin sheet of tin foil, the surface of the model is covered with a plate of gutta percha. the proper form is given it, and it is with this plate that the articulation is taken by known means. This plate, which is replaced upon the model, is then surrounded with soft wax, and the teeth are arranged on this same wax, the pins of which have been bent in an inverse way. It is then modeled, softened—in a word there is made with the gutta percha and the wax a piece just such as is wished to be had in rubber, giving it always a little more thickness, in order to allow the reduction which the scraping will make. When this operation is finished, the model is placed with the piece which covers it, the teeth uppermost, in the lower part of the muffle, which has just been filled with plaster freshly tempered. (Here enters Fig. 1.)

In Fig. 1, the piece A represents the lower part of the muffle filled with plaster and supporting the model, as well as the piece in wax. The plaster is carefully oiled, the upper part B is placed on the base A; plaster is run into this part and on the piece itself, care being taked to avoid air bubbles. The lid D, in which has also been put a small quantity of plaster, is then fixed on the part B. The ring C is then put on and the vice screwed up in such a manner that the three parts of the

muffle are perfectly held one to another. When the plaster is sufficiently hard, the muffle is warmed lightly and the part A separated from the part B; the teeth are then found to be firmly held together in the upper part as well as the wax and the gutta percha plate. These two articles are removed with care. The upper part F, Fig. 2, is then ready to receive the rubber, which has been cut into little strips, and which has been softened in a small vessel or other small apparatus capable of holding hot water. The rubber is forced into the cavity, care being taken to prevent the entrance of air or moisture.

As far as possible quite a large quantity of rubber must be put in, rather more than less, the excess escaping later and during the vulcanizing by the grooves which have been made on the surface of the plaster, and which are seen in Fig. 2, F. (Here enters Fig. 2.)

848 A sheet of tin foil is then placed on the part which represents the mouth on the piece G, a thin layer of gum somewhat liquid having been passed previously, in order to make it adhere well, and it is smoothed with a ball of cotton slightly impregnated with oil. The part G is then replaced upon the part F. The ring is put on and screwed up. The muffle is warmed in such a manner that the rubber which it contains becomes entirely soft. It is screwed up again until there is no more space between the lower part and the upper part. In this manner no risk is run of breaking the models or displacing the teeth.

OF THE VULCANIZATION.

The apparatus which we use can be warmed, it does not matter in what manner; the vulcanization is wrought by the heat of steam. (Here enters Fig. 3.)

It is constructed in such a way that the water is never obliged to be renewed during the operation, nor does it have to contain more than a minimum quantity of water, that is to say, as far as the grate upon which have been placed the muffles which contain the pieces to be vulcanized. The lid of the apparatus is then adjusted, the pressure screw is screwed up, the weight B is placed upon the lever of the safety-valve, the thermometer is put in the space C, in which care has been taken to put a certain quantity of mercury in such a way that the bulb of the thermometer is always surrounded by the liquid metal. At the neck D, fixed on the escape-cock E, the manometer, if desired, is placed.

Before commencing the vulcanizing it is always necessary to clean the little piece of the valve and the cock with a little ordinary oil, in order to avoid any leakage of steam.

When these muffles have been placed in the apparatus, and this latter has been prepared, as has been said above, heat gradually is applied until the thermometer marks 155 degrees centigrade, or the manometer, if this latter is employed, 5 atmospheres and a half. The same degree of heat is preserved for an hour and a quarter or an hour and a half, or longer, according to the degree of hardness wished to be obtained. The steam is then let off, the lid removed, the muffles withdrawn and put into cold water until they are perfectly cooled off.

849 MEANS OF FINISHING AND OF POLISHING RUBBER PIECES.

In the first place the rasp is used to remove from the piece all the superfluous parts and to give it the form which is desired. Then it is rubbed by means of instruments of various forms; then emery-paper of different

coarseness is used; then it is polished with the aid of a pumice-stone and water. The final gloss is given it by aid of tripoli or Spanish whiting.

The quickest way to polish is that of employing a circular brush mounted upon a lathe. It is necessary to take care not to touch either with the file or the scarpers the part of the piece which is to come in contact with the palate or the gums.

It will be easy to cause the sheet of tin foil to disappear by means of a little muriatic acid or nitric acid.

85 United States circuit court, district of Massachusetts. In equity.

THE GOODYEAR DENTAL VULCANITE COMpany et al.
vs.
DANIEL H. SMITH.

It is hereby stipulated and agreed that the annexed and foregoing eighty-seven printed pages contain true copies of the articles, or of the extracts from the articles, marked Defendant's Exhibits 38 to 56, both inclusive (excepting the translations appended to the exhibits marked 52, 53, 54), and that the same may be filed in the cause, and read and used at the hearing, in lieu of the original publications; either party being at liberty to use the originals, or any part or parts of said articles, or of any of them which are not printed herein. Def't's Exhibit No. 57 is admitted to be a true copy, but the objection to the original is not waived.

LEE & ALVORD,
Compl'ts' Sol.
HENRY BALDWIN, JR.,
For Defendant.

PHILA., *Nov. 11th*, 1873.

851 United States circuit court, district of Massachusetts. In equity.

THE GOODYEAR DENTAL VULCANITE COMpany et al.
vs.
DANIEL H. SMITH.

The complainants hereby waive any objection that might be had or taken to the Defendant's Exhibits numbers 6, 7, 8, 12, 13, 14, 15, 16, 17, 18, 19, and 20, so far as regards the further authentication of the same; and further, they withdraw the objection noted upon the record to Defendant's Exhibits 6, 7, and 8.

LEE & ALVORD,
Compl'ts' Sol.

PHILA., *Nov. 14th*, 1873.

It is further agreed that the patent of E. T. Truman, No. 12241, dated August 15th, 1848, being Def't's Exhibit No. 12, is the one intended to be referred to in def't's answer, and that the answer may be amended accordingly.

LEE & ALVORD,
Compl'ts' Sol.

852 The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the letters patent granted John A. Cummings, dated June 7th, 1864, No. 43009, for "Improvement in artificial gums and palates."

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this eighteenth day of September, in the year of our Lord one thousand eight hundred and seventy-two, and of the Independence of the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

No. 43009.

The United States of America to all to whom these letters patent shall come:

Whereas John A. Cummings, of Boston, Massachusetts, has alleged that he has invented a new and useful improvement in artificial gums and palates, which he states has not been known or used before his application; has made oath that he is a citizen of the United States, that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty-five dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are therefore to grant, according to law, to the said John A. Cummings, his heirs, administrators, or assigns, for the term of seventeen years from the seventh day of June, one thousand eight hundred and sixty-four, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said John A. Cummings, in the schedule hereunto annexed, and is made part of these presents.

853 In testimony whereof I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand, at the city of Washington, this seventh day of June, in the year of our Lord one thousand eight hundred and sixty-four, and of the Independence of the United States of America the eighty-eighth.

J. P. USHER,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.

[L. S.]

D. P. HOLLOWAY,
Commissioner of Patents.

The schedule referred to in these letters patent, and making part of the same.

To all persons to whom these presents shall come:

Be it known that I, John A. Cummings, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and use-

ful improvements in the manner of forming artificial palates and gums used for inserting artificial teeth, and that the following description, taken in connection with the accompanying drawings hereafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said invention by which it may be distinguished from others of a similar class, together with such parts as I claim and desire to have secured to me by letters patent.

The figures of the accompanying plates of drawings represent my improvements. Fig. 1 is a front elevation of a set of artificial teeth and plates formed by my improved method. Fig. 2 is a view of the lower side of the plates and teeth. Fig. 3 is a central vertical section of the same.

The method hitherto practiced of attaching artificial teeth to a metallic plate fitting to the roof of the mouth is attended with many objections and inconveniences, as the plate being hard and unyielding naturally hurts the mouth, and in some degree impedes mastication and perfect articulation, while the expense of the metal employed prevents many from availing themselves of the advantages of artificial teeth.

The present invention consists in forming the plate and gums to which the teeth are attached of rubber or some other elastic material, so indurated as to be rigid enough for the purposes of mastication, and pliable enough to yield a little to the motions of the mouth, and in one piece, the teeth being imbedded in the elastic material while the
854 said material is in a soft condition, and then baked with the gums and plates so that the teeth, gums, and plates will all be connected, forming as it were one piece.

a, *a*, *a*, etc., in the drawings, represent the artificial teeth prepared in the usual manner. The plate and gums, *b*, *b*, are formed in one piece, and of rubber or of rubber and the compounds commonly employed therewith, or of gutta-percha, or, in fact, of any elastic substance which can be reduced to a soft condition and then vulcanized or hardened sufficiently to answer the purpose. The rubber or other material used is first moulded to fit the shape of the mouth, and the gums formed, and while soft and pliable, the teeth, *a*, *a*, are imbedded in the gums, and as an additional security fastened to the same by small pins, *c*, *c*, Fig. 3. The teeth, gums, and plate being thus connected, are then baked until the elastic material becomes sufficiently vulcanized, when the process is completed, the plate being hard and rigid enough for the purposes of mastication, and yet by its elastic nature yielding to the motions of the mouth, while the teeth are firmly imbedded as secured in the gums. The plate and gums can be colored in any proper manner to imitate nature.

Having thus described by improvements, I shall state my claim as follows:

What I claim as my invention, and desire to have secured to me by letters patent, is—

Forming the plate and gums in which the teeth are inserted in one piece of hard rubber or vulcanite, i. e. an elastic material which can be hardened sufficiently for the purpose of mastication, and retain a portion of its elasticity so as to yield a little to the motion of the mouth, as herein set forth, and for the purposes specified.

JOHN A. CUMMINGS.

Witnesses:
A. POLLOK.
J. L. COOMBS.

855 The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy, from the files of this office, of the file wrapper and contents in the matter of the reissued letters patent granted Dental Vulcanite Co., dated January 18th, 1865, No. 1848, for "Improvement in artificial gums and palates."

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this eighteenth day of September, in the year of our Lord one thousand eight hundred and seventy-two, and of the Independence of the United States the ninety-seventh.

[L. S.] J. M. THACHER,
Acting Commissioner.

BOSTON, *December 19th*, 1864.

To the Hon. COMMISSIONER OF PATENTS:

Please allow A. Pollok, of Washington, D. C., to act in my stead in the matter of J. A. Cummings's application for reissue of patent for improvement in plates for artificial teeth.

JOSEPH GAVETT.

To the Hon. COMMISSIONER OF PATENTS:

The petition of John A. Cummings, of Boston, in the county of Suffolk and State of Massachusetts, respectfully represents—

That he did obtain letters patent of the United States for an improvement in artificial gums and palates, which letters patent are dated on the seventh day of June, A. D. 1864; that he now believes that the same are inoperative and invalid by reason of a defective specification, which defect has arisen from inadvertence and mistake; he therefore prays that he may be allowed to surrender the same, and requests that new letters patent may issue to him, for the same invention, for the residue of the period for which the original patent was granted, under the amended specification herewith presented, he having paid thirty dollars into the Treasury of the United States, agreeably to the act of Congress in that case made and provided.

JOHN A. CUMMINGS.

BOSTON, *December 14th*, 1864.

856 To the Hon. COMMISSIONER OF PATENTS:

Fifty cents. 50 United States. J. A. C. Dec. 14, 1864. United States. Fifty cents. 50

SIR: I hereby recognize and appoint Joseph Gavett, of Boston, or his accredited agent or agents, as my agent and attorney to solicit and receive letters patent for a reissue of my improvement in artificial gums and palates; also for withdrawing my application for the same, should it be found necessary; and in general to do all such things in the premises as he may deem to be for my advantage.

JOHN A. CUMMINGS.

STATE OF MASSACHUSETTS,
County of Suffolk, ss:

On this fourteenth day of December, A. D. 1864, before the subscriber, a justice of the peace, personally appeared the aforenamed John A. Cummings, and made solemn oath that he verily believes that by reason of an insufficient or defective specification, his aforesaid patent is not fully valid and available to him, and that the said error has arisen from inadvertence,

5 5 J. G. Dec. 14, 1864 5 5

accident, or mistake, and without any fraudulent or deceptive intention, to the best of his knowledge or belief.

JOSEPH GAVETT,
Justice of the Peace.

To all persons to whom these presents shall come:

Be it known that I, John A. Cummings, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful improvements, in plates for artificial teeth, and that the following description, taken in connection with the accompanying plate of drawings hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said improvements, by which my invention may be distinguished from all others of a similar class, together with such parts as I claim and desire to have secured to me by letters patent.

The method hitherto practiced of attaching artificial teeth to a metallic plate fitting to the roof of the mouth is attended with many objections and inconveniences, as the plate being hard and unyielding naturally hurts the mouth, and in some degree impedes mastication and perfect articulation, while the expense of the metal employed prevents many from availing themselves of the advantages of artificial teeth.

My present invention consists in forming the plate to which the
857 teeth, or teeth and gums, are attached, of hard rubber or vulcanite, so called, an elastic material, possessing and retaining in use sufficient rigidity for the purpose of mastication, and at the same time being pliable enough to yield a little to the motions of the mouth.

My manner of making and using said hard rubber plates is as follows: A wax or plaster impression of that part of the mouth which the plate is to fit is first taken, and from that impression a plaster cast is made which will exactly resemble that part of the mouth from which the first impression was taken. A plate of wax of the general form of the intended rubber plate is then made from this plaster cast, and around the front of this wax plate a vertical ridge of wax is fixed in about the position which the teeth are to occupy, in the same manner as is generally practiced in the construction of gold plates for artificial teeth. A plaster mould is then made from this wax plate, fitting it both in the upper and under side, which plaster mould is known generally as the articulator, and is constructed so as to hold the wax plate securely and conveniently for manipulation, leaving the front edge where the teeth are to be applied exposed and accessible.

The figures of the accompanying plate of drawings represent my improvements. Fig. 1 is a front elevation of a set of artificial teeth and plate formed by my improved method. Fig. 2 is a view of the lower side of the plate and teeth. Fig. 3 is a central vertical section of the same.

The teeth shown in the drawings are gum teeth, so called—that is, having porcelain gums formed in one piece with the teeth, and properly colored, and they are shown each one separate. But they may be without porcelain gums, in which case the palate and gums will be formed in one piece of hard rubber, and if gum teeth they may be formed in groups of two or more as desired. My mode of operation is the same, whether gum teeth or teeth alone are used, or separate or in groups. The teeth are set in place in the wax plate, and adjusted to the proper distance and fullness, in the same manner as is generally practiced in setting teeth in gold plates.

In the drawings the gum teeth are made separate, and marked *a*, *a*.

855 The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy, from the files of this office, of the file wrapper and contents in the matter of the reissued letters patent granted Dental Vulcanite Co., dated January 18th, 1865, No. 1848, for "Improvement in artificial gums and palates."

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this eighteenth day of September, in the year of our Lord one thousand eight hundred and seventy-two, and of the Independence of the United States the ninety-seventh.

[L. S.] J. M. THACHER,
Acting Commissioner.

BOSTON, *December 19th*, 1864.

To the Hon. COMMISSIONER OF PATENTS:

Please allow A. Pollok, of Washington, D. C., to act in my stead in the matter of J. A. Cummings's application for reissue of patent for improvement in plates for artificial teeth.

JOSEPH GAVETT.

To the Hon. COMMISSIONER OF PATENTS:

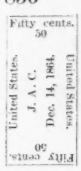
The petition of John A. Cummings, of Boston, in the county of Suffolk and State of Massachusetts, respectfully represents—

That he did obtain letters patent of the United States for an improvement in artificial gums and palates, which letters patent are dated on the seventh day of June, A. D. 1864; that he now believes that the same are inoperative and invalid by reason of a defective specification, which defect has arisen from inadvertence and mistake; he therefore prays that he may be allowed to surrender the same, and requests that new letters patent may issue to him, for the same invention, for the residue of the period for which the original patent was granted, under the amended specification herewith presented, he having paid thirty dollars into the Treasury of the United States, agreeably to the act of Congress in that case made and provided.

JOHN A. CUMMINGS.

BOSTON, *December 14th*, 1864.

856 To the Hon. COMMISSIONER OF PATENTS:

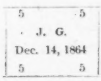


SIR: I hereby recognize and appoint Joseph Gavett, of Boston, or his accredited agent or agents, as my agent and attorney to solicit and receive letters patent for a reissue of my improvement in artificial gums and palates; also for withdrawing my application for the same, should it be found necessary; and in general to do all such things in the premises as he may deem to be for my advantage.

JOHN A. CUMMINGS.

STATE OF MASSACHUSETTS,
County of Suffolk, ss:

On this fourteenth day of December, A. D. 1864, before the subscriber, a justice of the peace, personally appeared the aforenamed John A. Cummings, and made solemn oath that he verily believes that by reason of an insufficient or defective specification, his aforesaid patent is not fully valid and available to him, and that the said error has arisen from inadvertence,



accident, or mistake, and without any fraudulent or deceptive intention, to the best of his knowledge or belief.

JOSEPH GAVETT,
Justice of the Peace.

To all persons to whom these presents shall come:

Be it known that I, John A. Cummings, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful improvements, in plates for artificial teeth, and that the following description, taken in connection with the accompanying plate of drawings hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said improvements, by which my invention may be distinguished from all others of a similar class, together with such parts as I claim and desire to have secured to me by letters patent.

The method hitherto practiced of attaching artificial teeth to a metallic plate fitting to the roof of the mouth is attended with many objections and inconveniences, as the plate being hard and unyielding naturally hurts the mouth, and in some degree impedes mastication and perfect articulation, while the expense of the metal employed prevents many from availing themselves of the advantages of artificial teeth.

My present invention consists in forming the plate to which the
857 teeth, or teeth and gums, are attached, of hard rubber or vulcanite, so called, an elastic material, possessing and retaining in use sufficient rigidity for the purpose of mastication, and at the same time being pliable enough to yield a little to the motions of the mouth.

My manner of making and using said hard rubber plates is as follows: A wax or plaster impression of that part of the mouth which the plate is to fit is first taken, and from that impression a plaster cast is made which will exactly resemble that part of the mouth from which the first impression was taken. A plate of wax of the general form of the intended rubber plate is then made from this plaster cast, and around the front of this wax plate a vertical ridge of wax is fixed in about the position which the teeth are to occupy, in the same manner as is generally practiced in the construction of gold plates for artificial teeth. A plaster mould is then made from this wax plate, fitting it both in the upper and under side, which plaster mould is known generally as the articulator, and is constructed so as to hold the wax plate securely and conveniently for manipulation, leaving the front edge where the teeth are to be applied exposed and accessible.

The figures of the accompanying plate of drawings represent my improvements. Fig. 1 is a front elevation of a set of artificial teeth and plate formed by my improved method. Fig. 2 is a view of the lower side of the plate and teeth. Fig. 3 is a central vertical section of the same.

The teeth shown in the drawings are gum teeth, so called—that is, having porcelain gums formed in one piece with the teeth, and properly colored, and they are shown each one separate. But they may be without porcelain gums, in which case the palate and gums will be formed in one piece of hard rubber, and if gum teeth they may be formed in groups of two or more as desired. My mode of operation is the same, whether gum teeth or teeth alone are used, or separate or in groups. The teeth are set in place in the wax plate, and adjusted to the proper distance and fullness, in the same manner as is generally practiced in setting teeth in gold plates.

In the drawings the gum teeth are made separate, and marked *a*, *a*.

The wax plate and gums, with the teeth adhering thereto, are now set upon the original plaster cast of the corresponding part of the mouth, and plaster is poured all around up to about the lower edge (as it lies) of the wax plate; the margin or outlying surface of plaster is oiled or varnished, and plaster poured over the whole, forming a complete mould of the plate and teeth. Upon the opening of this mould, the wax is warmed and removed so as to leave the teeth adhering in the plaster mould in exactly the relative position they are to occupy in the hard rubber plate. The teeth are provided with pins, *c*, *c*, projecting therefrom in such a manner that the rubber which is to constitute the
858 plate will close around them, and by means of them hold or secure the teeth permanently in position. The plaster mould with the teeth adhering therein, as just described, is now filled with soft rubber a little at a time, pressed in with the finger or in other convenient way, and care is to be taken that the rubber is made to completely fit into the cavities and around the protuberances (including the pins), and is filled in to the thickness or depth desired to form the plate. I then lock the rubber plate in position by shutting the other half of the plaster mould over it, to insure its retaining its exact form while warming, and then heat or bake it in an oven, or in any other suitable way. The soft rubber or gum so inserted in the mould is to be compounded with sulphur, rubber, etc., in the manner prescribed in the patent of Nelson Goodyear, dated May 6th, A. D. 1864, for making hard rubber, and is to be subjected to sufficient heat to vulcanize or harden it, substantially as directed in that patent. It is also to be colored in imitation of the natural gum, by mixing it with vermilion or other suitable coloring matter while in the soft state. After the plate has been heated sufficiently to harden it or convert it into hard rubber, or vulcanize it, so called, the mould is removed and the plate is polished ready for use.

Having thus described the method I have used for making and using hard rubber or vulcanite plates, what I claim herein and desire to secure by letters patent is the plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth, or teeth and gums, substantially as described.

JOHN A. CUMMINGS.

Witnesses:
JOSEPH GAVETT,
SAMUEL M. BARTON.

Memorandum of fee paid at United States Patent Office.

Inventor, J. A. Cummings.
Invention, artificial palate.
Date of payment, May 23d, 1864.
Fee, $20.
Solicitor, Pollok.

859 Reissue No. 1848. 1864. $\frac{6\,7}{1\,9}$.

John A. Cummings, ass'r. through mesne assignments to the Dental Vulcanite Company of same place, of Boston, county of Suffolk, State of Mass.

Artificial gums and palates.
Received December 21st, 1864.
Petition " "
Affidavit " "
Specification " "
1 drawing " "

Old patent " "
1 cert. dep. $30 " "
Cash.
Add'l fee cert.
" " cash.
Examined, Chas. G. Page, December 22d, 1864.
2 issue, Hayes " 30th, "
3 patented June 7th, "
Reissue January 10th, 1865.
Recorded vol. 14, page 380.
Circular.
Letter, Jan'y 23d, 1865.
J. Gavett, Boston, Mass.
T. C. S., associate.
A. A. Pollok, president.

860 The United States Patent Office, to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy, from the files of this office, of the file-wrapper and contents in the matter of the reissued letters patent granted the Dental Vulcanite Company, dated March 21st, 1865, No. 1904, for "improvement in artificial gums and palates."

In testimony whereof, I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this sixteenth day of September, in the year of our Lord one thousand eight hundred and seventy-two, and of the Independence of the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

BOSTON, *January 19th*, 1865.

To the Hon. COMMISSIONER OF PATENTS:

SIR: As all my rights in the patent for "artificial gums and palates" are assigned to the "Dental Vulcanite Company," of Boston, which assignment is on record at the Patent Office, I hereby request that the reissued patent, No. 1848, may be so amended as to recite the fact that the said reissue is granted to the said "Dental Vulcanite Company."

JOHN A. CUMMINGS.

BOSTON, *January 19th*, 1865.

To the Hon. COMMISSIONER OF PATENTS:

SIR: I herewith enclose the request of John A. Cummings, that the reissued patent, No. 1848, for "artificial gums and palates," may be so engrossed as to show the fact that granted to the "Dental Vulcanite Company."

I also beg to call your attention to the fact that the reference to the patent of Nelson Goodyear is wrongly copied. It should be dated May 6th, 1851, instead of 1864.

Your obedient servant,

JOSEPH GAVETT.

To the Hon. COMMISSIONER OF PATENTS:

The petition of John A. Cummings, of Boston, in the county of Suffolk and State of Massachusetts, respectfully represents:

861 That he did obtain letters patent of the United States for improvements in artificial gums and palates, which letters patent are dated on the seventh day of June, 1864; that he now believes that the same are inoperative and invilid, by reason of a defective specification, which defect has arisen from inadvertence and mistake. He therefore prays that he may be allowed to surrender the same, and requests that new letters patent may issue to the "Dental Vulcanite Company," of Boston, Massachusetts, for the same invention, the same having been assigned to the said company for the residue of the period for which the original patent was granted, under the amended specification herewith presented, it having paid thirty dollars into the Treasury of the United States, agreeably to the requirements of the act of Congress in that case made and provided.

JOHN A. CUMMINGS.

BOSTON, *February 16th*, 1865.

STATE OF MASSACHUSETTS,
County of Suffolk, ss:

5 5 J. G. Feb. 17th, 1865. 5 5

On this seventeenth day of February, A. D. 1865, before the subscriber, a justice of the peace, personally appeared the above-named John A. Cummings, and made solemn oath that he verily believes that by reason of an insufficient or defective specification his aforesaid patent is not fully valid and available to him, and that the said error has arisen from inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, to the best of his knowledge or belief.

JOSEPH GAVETT,
Justice of the Peace.

To the Hon. COMMISSIONER OF PATENTS:

Fifty cents. 50. J. A. C. Feb. 17th, 1865. 50. Life Insurance.

SIR: I hereby recognize and appoint A. Pollok, of Washington, D. C., or his accredited agent or agents, as agent and attorney to solicit and receive letters patent for reissue of patent for improvements in artificial gums and palates, and in general to do all such things in the premises as he may deem it to be for my advantage.

JOHN A. CUMMINGS.

BOSTON, *February 16th*, 1865.

To all persons to whom these presents shall come:

Be it known that I, John A. Cummings, of Boston, in the county of Suffolk, and State of Massachusetts, have invented certain new and useful improvements in plates for artificial teeth; and that the

862 following description, taken in connection with the accompanying plate of drawings hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said improvements, by which my invention may be distinguished from all others of a similar class, together with such parts as I claim and desire to have secured to me by letters patent.

The method hitherto practiced of attaching artificial teeth to a metallic plate fitting to the roof of the mouth is attended with many objections and inconveniences, as the plate, being hard and unyielding,

naturally hurts the mouth, and in some degree impedes mastication and perfect articulation, while the expense of the metal employed prevents many from availing themselves of the advantage of artificial teeth.

My present invention consists in forming the plate to which the teeth or teeth and gums are attached of hard rubber or "vulcanite," so called, an elastic material, possessing and retaining in use sufficient rigidity for the purpose of mastication, and at the same time being pliable enough to yield a little to the motions of the mouth.

My manner of making and using said hard rubber plates is as follows: A wax or plaster impression of that part of the mouth which the plate is to fit is first taken, and from that impression a plaster cast is made, which will exactly resemble that part of the mouth from which the first impression was taken. A plate of wax, of the general form of the intended rubber plate, is then made from this plaster cast; and around the front of this wax plate a vertical ridge of wax is fixed, about in the position which the teeth are to occupy, in the same manner as is generally practiced in the construction of gold plates for artificial teeth. A plaster mould is then made from this wax plate, fitting it both on the upper and under side, which plaster mould is known generally as the articulator, and is constructed so as to hold the wax plate securely and conveniently for manipulation, leaving the front edge, where the teeth are to be applied, exposed and accessible. The figures of the accompanying plate of drawings represent my improvements. Fig. 1 is a front elevation of a set of artificial teeth and plate formed by my improved method. Fig. 2 is a view of the lower side of the plate and teeth. Fig. 3 is a central vertical section of the same.

The teeth shown in the drawings are gum teeth, so called; that is, having pocelain gums formed in one piece with the teeth, and properly colored, and they are shown each one separate. But they may be without porcelain gums, in which case the palate and gums will be formed in one piece of hard rubber, and, if gum teeth, they may be formed in groups of two or more, as desired. My mode of operation is the same whether gum teeth or teeth alone are used, or separate or in groups.

863 The teeth are set in place in the wax plate, and adjusted to the proper distance and fulness in the same manner as is generally practiced in setting teeth in gold plates. In the drawing the gum teeth are made separate, and marked *a*, *a*. The wax plate and gums, with the teeth adhering thereto, is now set upon the original plaster cast of the corresponding part of the mouth, and plaster is poured all around up to about the lower edge (as it lies) of the wax plate, the margin or outlying surface of plaster is oiled or varnished, and plaster poured over the whole, forming a complete mould of the plate and teeth. Upon the opening of this mould the wax is warmed and removed, so as to leave the teeth adhering in the plaster mould in exactly the relative position they are to occupy in the hard rubber plate. The teeth are provided with pins, *c*, *c*, projecting therefrom in such manner that the rubber which is to constitute the plate will close around them, and by means of them hold or secure the teeth permanently in position. The plaster mould, with the teeth adhering therein, as just described, is now filled with soft rubber, a little at a time, pressed in with the finger or in other convenient way, and care is to be taken that the rubber is made to completely fit into the cavities and around the protuberance (including the pins), and is filled in to the thickness or depth desired to form the plate. I then lock the rubber plate in position by shutting the other half of the plaster mould over it, to insure its retaining its exact form while warming, and then heat or bake it in an oven,

or in any other suitable way. The soft rubber or gum so inserted in the mould is to be compounded with sulphur, rubber, etc., in the manner prescribed in the patent of Nelson Goodyear, dated May 6th, A. D. 1851, for making hard rubber, and it is to be subjected to sufficient heat to vulcanize or harden it, substantially as directed in that patent. It is also to be colored in imitation of the natural gums by mixing it with vermilion or other suitable coloring matter, while in the soft state. After the plate has been heated sufficiently to harden it, or convert it into hard rubber or "vulcanite," so called, the mould is removed, and the plate is polished ready for use.

Having thus described the method I have used for making and using said hard rubber or vulcanite plates, what I claim herein, and desire to secure by letters patent, is—

The plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth or teeth and gums, substantially as described.

JOHN A. CUMMINGS.

Witnesses:
JOSEPH GAVETT.
SAMUEL M. BARTON.

864 Reissue No. 1904. 1865. $\frac{12}{17}$.

John A. Cummings, of Boston, county of Suffolk, State of Massachusetts, ass'or through mesne assignments to the Dental Vulcanite Company, of same place. Artificial gums and palates.

Received	February 27th, 1865.	
Petition	"	"
Affidavit	"	"
Specification	"	"
2 Drawings	"	"
Old Pat.	"	"
Cert. dep.		
1 Cash, $30	February 27th, 1865.	
Add'l fee cert.		
" cash.		
Examined, Charles G. Page, March 6th, 1865.		
2 Issue, Hayes	March 9th, 1865.	
4 Patented	June 7th, 1864.	
Reissued	January 10th, 1865.	
Again reissued	March 21st, 1865.	
Recorded vol. 15, page 142.		
Circular.		
A. Pollok, pres't.		

865 The United States Patent Office, to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy, from the records of this office, of the reissued letters patent granted Dental Vulcanite Company, dated March 21st, 1865, No. 1904, for "Improvement in artificial gums and palates."

In testimony whereof, I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this twentieth day of September, in the year of our Lord one thousand eight hundred and seventy-two, and of the Independence of the United States the ninety-seventh.

[L. S.]

J. M. THACHER,
Acting Commissioner.

The United States of America to all to whom these letters patent shall come:

Whereas John A. Cummings, of Boston, Massachusetts (he having assigned his right, title and interest in said improvement to the Dental Vulcanite Company, of the same place), has alleged that he has invented a new and useful improvement in artificial gums and palates (for which latters patent were issued to him, dated June 7th, 1864, the same surrendered, and new letters ordered to issue to the Dental Vulcanite Company, dated January 10th, 1865, which second letters having been surrendered by them, the same have been cancelled and new letters ordered to issue to them on an amended specification), which he states has not been known or used before his application; has made oath that he is a citizen of the United States, that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; said assignees having paid into the treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are therefore to grant, according to law, to the said Dental Vulcanite Company, their successors, or assigns, for the term of seventeen years from the seventh day of June, one thousand eight hundred and sixty-four, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said im-
866 provement, a description whereof is given in the words of the said John A. Cummings, in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand at the city of Washington, this twenty-first day of March, in the year of our Lord one thousand eight hundred and sixty-five, and of the Independence of the United States of America the eighty-ninth.

J. P. USHER,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[L. S.] D. P. HOLLOWAY,
Commissioner of Patents.

The schedule referred to in these letters patent, and making part of the same.

To all persons to whom these presents shall come:

Be it known that I, John A. Cummings, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful improvements in plates for artificial teeth, and that the following description, taken in connection with the accompanying plate of drawings hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said improvements by which my invention may be distinguished from all others of a similar class, together with such parts as I claim and desire to have secured to me by letters patent.

The method hitherto practiced of attaching artificial teeth to a metallic plate, fitting to the roof of the mouth, is attended with many ob-

jections and inconveniences, as the plate, being hard and unyielding, naturally hurts the mouth, and in some degree impedes mastication and perfect articulation, while the expense of the metal employed prevents many from availing themselves of the advantage of artificial teeth.

My present invention consists in forming the plate to which the teeth or teeth and gums are attached of hard rubber or "vulcanite," so called—an elastic material possessing and retaining in use sufficient rigidity for the purpose of mastication, and at the same time being pliable enough to yield a little to the motions of the mouth.

My manner of making and using said hard rubber plates is as
867 follows: A wax or plaster impression of that part of the mouth which the plate is to fit is first taken, and from that impression a plaster cast is made which will exactly resemble that part of the mouth from which the first impression was taken. A plate of wax of the general form of the intended rubber plate is then made from this plaster cast; and around the front of this wax plate a vertical ridge of wax is fixed about in the position which the teeth are to occupy, in the same manner as is generally practiced in the construction of gold plates for artificial teeth. A plaster mould is then made from this wax plate, fitting it both on the upper and under side, which plaster mould is known generally as the articulator, and is constructed so as to hold the wax plate securely and conveniently for manipulation, leaving the front edge, where the teeth are to be applied, exposed and accessible.

The figures of the accompanying plate of drawings represent my improvements.

Fig. 1 is a front elevation of a set of artificial teeth and plate formed by my improved method.

Fig. 2 is a view of the lower side of the plate and teeth.

Fig. 3 is a central vertical section of the same.

The teeth shown in the drawings are gum teeth, so called; that is, having porcelain gums formed in one piece with the teeth, and properly colored, and they are shown each one separate. But they may be without porcelain gums, in which case the palate and gums will be formed in one piece of hard rubber, and if gum teeth, they may be formed in groups of two or more as desired. My mode of operation is the same, whether gum teeth or teeth alone are used, or separate or in groups.

The teeth are set in place in the wax plate, and adjusted to the proper distance and fullness in the same manner as is generally practiced in setting teeth in gold plates. In the drawing the gum teeth are made separate, and marked *a a*. The wax plate and gums, with the teeth adhering thereto, is now set upon the original plaster cast of the corresponding part of the mouth, and plaster is poured all around up to about the lower edge (as it lies) of the wax plate; the margin or outlying surface of plaster is oiled or varnished, and plaster poured over the whole, forming a complete mould of the plate and teeth. Upon the opening of this mould the wax is warmed and removed so as to leave the teeth adhering in the plaster mould in exactly the relative position they are to occupy in the hard rubber plate.

The teeth are provided with pins, *c c*, projecting therefrom in such manner that the rubber which is to constitute the plate will close around them, and by means of them hold or secure the teeth permanently in position. The plaster mould with the teeth adhering therein, as just described, is now filled with soft rubber, a little at a time, pressed in with the finger or in other convenient way, and care is to be taken
868 that the rubber is made to completely fit into the cavities and around the protuberances (including the pins), and is filled into

the thickness or depth desired to form the plate. I then lock the rubber plate in position by shutting the other half of the plaster mould over it, to insure its retaining its exact form while warming, and then heat or bake it in an oven or any other suitable way. The soft rubber or gum so inserted in the mould is to be compounded with sulphur, rubber, etc., in the manner prescribed in the patent of Nelson Goodyear, dated May 6th, A. D. 1851, for making hard rubber, and is to be subjected to sufficient heat to vulcanize or harden it substantially as directed in that patent. It is also to be colored in imitation of the natural gums by mixing it with vermilion or other suitable coloring matter while in the soft state. After the plate has been heated sufficiently to harden it or convert it into hard rubber or "vulcanite," so called, the mould is removed, and the plate is polished ready for use.

Having thus described the method I have used for making and using said hard rubber or vulcanite plates, what I claim herein, and desire to secure by letters patent, is the plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth or teeth and gums, substantially as described.

JOHN A. CUMMINGS.

Witnesses:
JOSEPH GAVETT.
SAM'L M. BARTON.

869 The following is a copy of the opinion in accordance with which the decree of this circuit court dismissing the bill of complaint in this cause was entered, October 5th, 1877, namely:

Opinion of the court.

SHEPLEY, J.:

The patent and its reissues granted for the invention of John A. Cummings of "an improvement in artificial gums and palates," or, as described in the claim, "the plate of hard rubber or its equivalent for holding artificial teeth, or teeth or gums, substantially as described," have been the subject of extensive and prolonged litigation. Since the affirmance by the Supreme Court of the United States, in Smith, appellant, v. Goodyear Dental Vulcanite Company (3 Otto, 486), of the decree of the circuit court in the test case of Goodyear Dental Vulcanite Company v. Smith, the validity of the reissued patent has been fully established. The decision of the Supreme Court in that case must be considered as final, not only as to the validity, but as to the construction of the patent, which was carefully considered in that case both in the circuit and the appellate
870 court, as it had previously been in the Wetherbee and the Gardner cases.

In Vulcanite Company v. Smith, in the first circuit, this court decided that the patent was not for a process or art, but for the new product resulting from the manipulation by the described new process, and for one of those products in which the process so adheres that the described product can only be made by the described process, and that the invention was one in which the process by which it is made is a part of the substance, the thing made, the manufacture. What the new product was, and wherein the novelty consisted, in the process, we shall hereafter have occasion to consider. In the opinion (by Mr. Justice Strong) in the Supreme Court in the same case, the invention patented is thus described: "The invention, then, is a product or manufacture made in a defined manner. It is not a product alone separated from the process

by which it is created. The claim refers in terms to the antecedent description, without which it cannot be understood. The process detailed is thereby made as much a part of the invention as are the materials of which the product is composed."

If the defendants, by practising the process described by Cummings, using the materials described by him, or such materials as are equivalents and were known equivalents at the date of his invention, in the described process, or such as, in the process, are mere substitutes of one material for another without any change in the process or in the effect, have produced a product the equivalent of his in the described properties, and for the described functions, then, and only then, have they infringed.

The product, the new article of manufacture patented, was a set of artificial teeth, consisting of a plate of hard rubber or vulcanite, with teeth or teeth and gums, secured thereto in the manner described
871 in the patent, by imbedding the teeth and pins in the vulcanizable compound, so that it shall surround the teeth and pins while the compound is in a soft state before it is vulcanized, so that, when the compound is vulcanized, the teeth are firmly secured by the pins imbedded in the vulcanite, and there is a tight joint between the vulcanite and the teeth. This product was a new product not alone because it substituted one material for another, the material, vulcanite rigid enough for purposes of mastication, yet pliable enough to yield a little to the mouth, and at the same time light and inexpensive, in place of the hard, unyielding, expensive and heavy metals previously used, but also in the additional fact that it was made by a process which, taken as a whole, was a new process, by the use of which process "the teeth can easily be baked into the gums, which form one piece with the plate."

The next question to be considered is, what was there new in the described process. The whole process of forming and making a set or case of teeth, including the plate, gums, and teeth, is fully described in the Cummings patent, and this process is so fully described in the case of Vulcanite Company v. Smith that it becomes unnecessary to repeat it here. It is sufficient to state that in view of the state of the art there was nothing substantially new in that process until we reach this part of the description: "The teeth are provided with pins projecting therefrom in such manner that the rubber which is to constitute the plate will close around them, and, by means of them, hold or secure the teeth permanently in position. The plaster mould, with the teeth adhering therein, as just described, is now filled with soft rubber, a little at a time, pressed in with the finger, or in any other convenient way; and care is to be taken that the rubber is made to completely fit into the cavities, and around the protuberances, including the pins, and is filled in to the thickness or depth desired to form the plate. I then lock the rubber plate in position by shutting the other half of the
872 plaster mould over it to insure its retaining its exact form while warming, and then heat or bake it in an oven, or in any other suitable way. The soft rubber or gum so inserted in the mould is to be compounded with sulphur, rubber, etc., in the manner prescribed in the patent of Nelson Goodyear, dated May 6, A. D. 1851, for making hard rubber, and is to be subjected to sufficient heat to vulcanize or harden it substantially as directed in that patent. It is also to be colored in imitation of the natural gums, by mixing it with vermillion or other suitable coloring matter, while in the soft state. After the plate has been heated sufficiently to harden it or convert it into hard rubber or

'vulcanite,' so called, the mould is removed and the plate is polished ready for use."

It will thus be seen that an essential element of the described product is "a plate of hard rubber or vulcanite," in which the teeth are imbedded, and an essential ingredient in the described process is the soft rubber or gum, compounded with sulphur, rubber, etc., in the manner prescribed in the patent of Nelson Goodyear for making hard rubber, and that an essential step in the described process is the subjecting the compound of soft rubber or gum with sulphur "to sufficient heat to vulcanize or harden it, substantially as described in that patent" (i. e., the patent of Nelson Goodyear, of May 6, A. D. 1851.)

The equivalent of that produce thus made by that process must therefore contain the equivalent of the plate of hard rubber made and manipulated by a process equivalent to the described process of compounding a gum with sulphur and applying it and moulding it and incorporating it with the teeth and gums when in a soft state, and then subjecting it to heat, to harden and vulcanize it in the manner described in the Goodyear patent, or in some equivalent manner or by some equivalent process.

The defendants use, in making their set of artificial teeth,
873 a plate made of "celluloid," substantially a new material, discovered and patented since the date of the Cummings inven*ven*tion. This substance is compounded of cellulose or vegetable fibre and camphor. No rubber or other equivalent gum, and no sulphur or equivalent for sulphur in the process, enter into its ingredients. It is not a vulcanizable compound, and contains no vulcanizing agents in its composition. The camphor in its composition instead of being a vulcanizing agent causes the composition to soften instead of harden under the influence of heat. The product when compounded and before being subjected to heat, is not soft, like soft rubber under like conditions, but hard. In the manipulation of this material the process of making a set of teeth composed of the plate and teeth and gums is an entirely different process from the process described in the Cummings patent when compared with that part of the Cummings process which was new in the state of art, and the novelty of which part gave to the Cummings process, when considered as a whole, the ingredient of novelty and patentability. It is not placed in the mould in a soft, plastic condition, "a little at a time, pressed in with the finger, or in any other convenient way," but in a hard, rigid condition, like horn, or bone, or ivory. It is then subjected to heat, not to vulcanize or harden, but to soften it. It afterwards, on being cooled or restored to its original temperature, returns to its original condition as a hard substance, as when first placed in the mould. No vulcanizing process, or even process of hardening by heat, and no equivalent for any such process, is practised. In the light of these comparisons it appears evident to the court that the use of celluloid in the manufacture of sets of artificial teeth, as practised by the defendants, and the manufacture itself, the set or plate of teeth differ as much, both as to process and product, from the process and product described and claimed in the Cummings patent, as
874 that process and that product differed from those previous manufactures which existed before the Cummings invention, and were unsuccessfully relied upon as anticipating it.

It is true that this construction of the dental vulcanite patent narrows the scope of the patent. It is urged with much force that if this be the true construction, it would follow that if an inventor invented at the same time a new process and a new product, he would by such a

construction of his patent lose the benefit of it, unless the infringer used his process, or an equivalent one, to produce his product or an equivalent one. One answer to this objection is that in the case supposed the inventor might patent both the new process and the new product, and thus fully protect himself. In its application to this case it is believed that the objection is without force, for the reason that such a construction of the claim of this patent is the only one which makes the claim a valid claim. To abandon the construction which makes the product patented the new manufacture, when made by the described process, is to abandon that which gives it its vitality. It is better to adopt that construction, which, although limiting the scope of the claim, secures to the inventor all that he actually invented and no more, than to adopt one which would render the patent invalid, or one which, being broader than the invention of the patentee, should be a barrier in the way of future progress in discovery and invention.

Bill dismissed.

875 UNITED STATES OF AMERICA.
Massachusetts District, ss:

I, John G. Stetson, clerk of the circuit court of the United States for the first circuit and district of Massachusetts, certify that the foregoing is a true copy of the evidence for defendant and of the opinion of the circuit court in the cause in equity entitled The Goodyear Dental Vulcanite Company complainants, v. Charles G. Davis, defendant, in said ciruit court determined.

And I further certify that the volume entitled Vol. I, Pleadings and Evidence for Complainants, containing my certificate of even
876 date herewith, and this volume entitled Vol. II, Evidence for Defendant and Opinion of the Circuit Court, taken together contain a true copy of the record and of all proceedings (including the opinion of the court) in said cause.

In testimony whereof I hereunto subscribe my name and affix the seal of said circuit court at Boston, in said district, this thirteenth day of October, in the year of our Lord one thousand eight hundred and seventy-seven, and of the Independence of the United States the one hundred and second.

[SEAL.] JOHN G. STETSON, *Clerk.*

(Indorsed:) Goodyear Dental Vulcanite Co. vs. Davis, Vol. II.

(Indorsement on cover:) No. 326. The Goodyear Dental Vulcanite Company, appellant, vs. Charles G. Davis, Massachusetts C. C. U. S. Filed 22 October, 1877.

FILED
NOV 6 1880

SUPREME COURT

OF THE UNITED STATES.

No. 67. October Term, 1880.

THE GOODYEAR DENTAL VULCANITE CO.,

vs.

CHARLES G. DAVIS.

Appeal from the Circuit Court of the United States for the District of Massachusetts.

BRIEF OF

B. F. LEE. WM. HENRY CLIFFORD.

For Appellant.

New-York:
BENJ. H TYRREL, Law Printer, 74 Maiden Lane.
-:-
1880.

Supreme Court of the United States,

OCTOBER TERM, 1880, No. 67.

THE GOODYEAR DENTAL VULCANITE CO., *Appellant*, *vs.* CHARLES G. DAVIS.

Appeal from the Circuit Court of the United States, for the District of Massachusetts.

BRIEF FOR APPELLANT.

This is an appeal from a decree in equity (p. 33), made by the Circuit Court of the United States, for the District of Massachusetts, on October 5, 1877, dismissing the complainants' bill, in a suit brought for the infringement of reissued Letters Patent, No. 1,904, dated March 21, 1865 (original, dated, June 7, 1864), granted to the Dental Vulcanite Co., assignee of John A. Cummings, for "improvements in artificial gums and palates" (Plff's, Ev., p. 97–99).

NATURE OF THE INVENTION.

The subject matter is expressed in the claim of the patent, which is as follows: "The plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth, or teeth and gums, substantially as described."

A dental plate or set of artificial teeth is composed of two parts, the "base" and the porcelain teeth. "Gum teeth" have porcelain gums made in one piece with the teeth. "Plain teeth" are without such gums.

In the specification, the inventor designates the invention as

"certain new and useful improvements in plates for artificial teeth." He then proceeds to set forth the nature and principles of his improvements, by which his invention may be distinguished from all others of a similar class.

He says (Plff's Ev., p. 98):

"The method hitherto practiced of attaching artificial teeth to a *metallic plate*, fitting to the roof of the mouth, is attended with many objections and inconveniences, as the plate being *hard* and *unyielding*, naturally hurts the mouth, and in some degree impedes mastication and perfect articulation; while the expense of the metal employed, prevents many from availing themselves of the advantage of artificial teeth."

"My present invention consists in forming the plate to which the teeth, or teeth and gums are attached, of hard rubber, or 'vulcanite,' so-called—*an elastic material, possessing and retaining in use, sufficient rigidity for the purpose of mastication, and at the same time, being pliable enough to yield a little to the motions of the mouth.*"

He proceeds to describe in detail, his mode of forming and making a "set" or "case" of teeth.

He says:

"My manner of making and using said hard-rubber plates, is as follows: A wax or plaster impression of that part of the mouth which the plate is to fit, is first taken, and from that impression a plaster cast is made, which will exactly resemble that part of the mouth from which the first impression was taken. A plate of wax of the general form of the intended rubber plate is then made from this plaster cast, and around the front of this wax plate, a vertical ridge of wax is fixed, about in the position which the teeth are to occupy."

This wax ridge is built upon the wax plate precisely as it would be built upon a gold plate, and the teeth are set in place and adjusted upon this wax ridge in the same manner as is generally practiced in setting teeth in gold plates. The result is a plate and gums or alveolar ridge of wax, with the roots of the artificial teeth embedded in the wax in precisely the relative position they are to occupy when the case is finished, the part in wax being of the precise form ultimately to be produced in vulcanite.

"The wax plate and gums, with the teeth adhering thereto, is now set upon the original plaster cast of the corresponding part of the mouth, and plaster is poured all round, up to about the lower edge (as it lies) of the wax plate. The margin, or outlaying surface of plaster is oiled or varnished, and plaster poured over the whole forming a complete mould of the plate and teeth. Upon the opening of this mould the wax is warmed and removed so as to leave the teeth adhering in the plaster mould in exactly the relative position they are to occupy in the hard rubber plate.'

"Complainant's Exhibit Bacon No. 1" shows the result attained at this stage (Plff's Ev., p. 49, Q. 4). An examination of this exhibit will greatly aid the Court. It shows a plaster mould in two parts or sections, the teeth being imbedded in the upper section, so that the roots with their pins extend down into the hollow of the mould. The iron box containing the plaster is called a "flask."

The patentee then describes the packing of this mould with plastic rubber, which, when it becomes hard, is to form the elastic plate or base for holding the artificial teeth in the finished case. He says (Plff's Ev., p. 98):

"The teeth are *provided with pins, c, c,* projecting therefrom in such manner that *the rubber which is to constitute the plate will close around them, and by means of them hold or secure the teeth permanently in position.* The plaster mould, with the teeth adhering therein, as just described, is now filled with soft rubber, a little at a time, pressed in with the finger, *or in any other convenient way; and care is to be taken that the rubber is made to completely fit into the the cavities, and around the protuberances, including the pins,* and is filled in to the thickness or depth desired to form the plate. I then lock the rubber plate in position by shutting the other half of the plaster mould over it, to insure its retaining its exact form while warming, and then heat or bake it in an oven, or in any other suitable way. The soft rubber, or gum so inserted in the mould, is to be compounded with sulphur, rubber, etc., in the manner prescribed in the patent of Nelson Goodyear, dated May 6, A. D. 1851, for making hard rubber, and is to be subjected, to sufficient heat to vulcanize or harden it, substantially as directed in that patent. It is also to be colored in imitation of the natural gums, by mixing it with vermilion, or other suitable coloring matter, while in the soft state. After the plate has been heated sufficiently to harden it, or convert it into hard rubber or 'vulcanite,' so-called, the mould is removed, and the plate is polished ready for use."

"Complainant's Exhibit Bacon No. 2" (Plff's Ev., p. 49) is a specimen of the colored rubber compound referred to.

"Complainants' Exhibit Vulcanite Partial Plate" (Plff's Ev., p. 185) "Complainant's Exhibit Hyatt No. 5" (Plff's Ev., p. 37) and are specimens of the patented article.

We shall have occasion hereafter to show in detail that the above description of the packing of the mould and of the hardening of the compound, although sufficient for all practical purposes, reference being had to the general art of moulding vulcanite, is not accurate.

It omits to state the fact well known to all skilled in working vulcanite that to mould the compound it must be rendered plastic by heat, usually by means of boiling water, and that hard rubber remains plastic so long as it is hot, hardening only on cooling (Plff's Ev., Warner, p. 46, p. 47, Q. 21, and p. 48, Q.

29–36; Bacon, p. 49, Flagg, p. 120, X-Q. 166 and Deft.'s Ev., Hyatt, p. 223, Q. 17; Colburn, p. 228, Q. 8; see also pp. 549, 551, 570).

Steam heat under pressure was in 1852 the usual mode of vulcanizing (Plff's Ev., p. 177, X-Q. 20).

"Exhibit Nute No. 4," is the press ordinarily used to force the two sections of the mould (Exhibit Bacon No. 1) together when packed full of plastic rubber (p. 190, Q. 21).

A brief notice of the pre-existing metal plates referred to by Cummings is necessary to the proper understanding of his specification, and of the advance he made in the art.

Defendant's witness, Dr. Alfred Starr, describes how the sets of teeth on the precious metals were made. He says (p. 245):

> "I first took an impression of the patient's mouth in wax; I then ran plaster on the wax and got a plaster model of the mouth; this plaster model was immersed in melted lead, and held there until the lead cooled and hardened; then the plaster was knocked out of the lead, and then the lead was smoked, and then hard metal, zinc or type metal—zinc was nearly always used—was cast against the lead, thus forming the male die, the lead being the female die; then we knocked them apart, and placed a sheet of the metal, cut out of suitable shape, between the dies, and swedged the plate between them; we then tried it in the mouth to see if it fitted, and then the teeth were ground to fit in the proper places, and then encased in sand and plaster around the outer face of the teeth, or convex side of the set of teeth, the teeth having been previously arranged upon the metal plate, in the position required, by means of wax placed around the inner or concave side of the set of teeth; when the sand and plaster became hard enough to hold the teeth in position, we removed all the wax, and then lined or backed the teeth by riveting gold upon the teeth; each tooth for metal work is provided with two pins; the gold is held by those pins by being riveted; each tooth or block of teeth had its own piece of gold; the whole is then gently heated to a red heat, and the backings are soldered to the plate, thus attaching the teeth to the plate; in making what are known as continuous gum sets of teeth, the plates being made of platinum, we dispensed with the backing, and soldered the pins to the plate."

For descriptions of this process see also pp. 49, 52.

"Complainant's Exhibit Bacon No. 3," shows the die, and "Complainant's Exhibit, Bacon, No. 4," shows the counter die, between which the plate was swaged by hammering, and "Complainant's Exhibit, Bacon No. 5," is a silver dental plate of the kind referred to (Plff's Ev., pp. 49–50).

"Defendant's Exhibit No. 28" is a specimen of a "continuous gum" set. "Defendant's Exhibit No. 29" is such a set of teeth in an unfinished state, showing how, "after the teeth being soldered to the plate," a vitreous compound is ap-

plied in successive layers and by successive bakings in a furnace, to build up the gums. Platinum alone will stand the requisite heat (Deft's Ev., p. 234).

Defendant's witness, Dr. Wildman, describes a third kind of gold or silver dental plate, of which "Defendant's Exhibit E, W, 13" is a specimen (Deft's Ev., p. 347). It is a stamped up silver plate, with a cast tin gum or alveolar ridge in which the roots of the teeth, with their pins, are embedded, the tin acting as a solder to unite the teeth with the plate.

This manufacture is altogether the nearest approach to what is described in the patent, from the fact that at that stage of the manufacture that immediately precedes the casting of the tin there is a plaster mould in two halves, one of which contains the teeth precisely like the mould prepared to be packed with plastic rubber. The stamped or hammered up silver or gold plate, however, fills that portion of the cavity of the mould which Cummings fills with plastic rubber to form the *plate proper*, thus leaving only a cavity corresponding to the *gum* or *alveolar ridge* which is to be cast in tin and perform the office of a solder to unite the teeth and plate.

"Defendant's Exhibit E, W, 12," represents the upper section of the plaster mould with the teeth embedded in it and "Defendant's Exhibit E, W, 12 A" represents the lower section of the mould with the silver plate embedded in it, prepared to receive the molten tin (Deft's Ev., p. 347).

We request the particular attention of the Court to these three exhibits of Dr. Wildman, because they are, as we shall show, the only pre-existing things, in the art of mechanical dentistry, that can be said to resemble in any way what is described in complainant's patent, *no matter what construction may be given to it.*

As we shall hereafter show these metal plates form the whole state of the art.

Having thus arrived at an understanding of the metal plates referred to in the patent as pre-existing, and the art of producing them and the nature of the vulcanite referred to in the patent, and the art of producing moulded forms of vulcanite, we are in a position to fully understand the specification.

Mr. Henry B. Renwick thus well expresses the nature of the invention (Plff's Ev., pp. 51–52):

"The invention as claimed may be described as a new article of manufacture, consisting of a plate of hard rubber, or vulcanite, or its equivalent, for holding arti-

ficial teeth, with teeth, or teeth and gums *secured thereto in the manner described in the patent*, the whole making what is sometimes called a case, or, in ordinary language, a set of artificial teeth. The manner described in the patent of securing the teeth to the plate is *by imbedding the teeth and pins in the plate, while the substance of which it is composed is in a soft, or plastic condition, so that when the material composing the plate becomes hard*, the teeth are firmly secured by being imbedded with their pins, in the substance composing the plate, so that there is a tight joint between the plate and the teeth, the whole forming substantially one piece. The material composing the plate must when hardened be an elastic material possessing and retaining in use sufficient strength and rigidity for the purpose of mastication, and at the same time being elastic enough to yield a little to the motions of the mouth.

"It may be said here as further illustrating my idea of what the invention is, that it does not consist in the *mere application* of vulcanite, or a substance possessing the same characteristics, for the required purpose, in place of metal: for instance, *if a plate of vulcanite were formed into proper shape, and the teeth were then riveted to it as they have been to a metal plate, then the completed article with the teeth riveted to the vulcanite would not be the new article of manufacture described in the Cummings patent.*"

DECISION OF SUPREME COURT SUSTAINING PATENT.

This patent has already been sustained by this Court in the case of *Smith vs. The Goodyear Dental Vulcanite Co.*, 93 *U. S.* 486.

All of the defences set up in the answer going to the validity of the patent have been disposed of by the decision of this Court in that case, these defences in the present case being the same as those relied on in that case, and all the testimony in said Smith case, deemed material by either party, having been incorporated by stipulation into this record before that case was decided by this Court.

The evidence in this case consists of the testimony so incorporated into this case from the Smith record, and certain additional testimony taken in six suits in the District of Maine bearing upon the question of infringement involved in this case. (See stipulations, pp. 109 and 31).

Defendant's Evidence taken from the Smith case is printed in the record beginning on page 293 and ending on page 583. Plaintiff's Evidence taken from the Smith case begins on page 109 and ends on page 174 of the record.

No question of infringement was involved in the Smith case. The answer admitted the use of the *precise thing patented* and there was no occasion therefore to consider what would or would not be an equivalent. (See H. B. Renwick, X-Q. 12 p. 57.)

The opinion of this Court, read by Mr. Justice Strong (3 Otto, p. 489), deals very strictly with the case then before the

Court. It gives a very clear description and explanation of the exact thing described in the specification. It substantially states that the thing described and claimed is a new article of manufacture made by a new process, and that the product itself is "a novel thing in kind, and consequently patentable as such." (3 Otto, p. 497.)

We quote all that portion of the opinion which bears upon this general subject (p. 492):

"Among these (defences) the one perhaps most earnestly urged is the averment that the device described in the specification was not a patentable invention, but that it was a mere substitution of vulcanite for other materials which had previously been employed as a base for artificial sets of teeth,—a change of one material for another in the formation of a product. If this is in truth all that the thing described and patented was, if the device was merely the employment of hard rubber for the same use, in substantially the same manner, and with the same effect that other substances had been used for in the manufacture of the same articles, it may be conceded that it constituted no invention. So much is decided in Hotchkiss *vs.* Greenwood, 11 How., 248. But such is not our understanding of the device described and claimed. In the specification it is declared that the invention "consists in forming the plate to which the teeth, or teeth and gums, are attached, of hard rubber or vulcanite, so called, an elastic material possessing and retaining in use sufficient rigidity for the purpose of mastication, and at the same time being pliable enough to yield a little to the motions of the mouth." This is immediately followed by a description of the manner of the proposed use; that is, of making the hard rubber plates: and the claim, as stated, is "the plate of hard rubber, or vulcanite, or its equivalent, for holding artificial teeth, or teeth and gums substantially as described;" that is, plainly, formed as described. The invention, then, is a product or manufacture made in a defined manner. It is not a product alone separated from the process by which it is created. The claim refers in terms to the antecedent description, without which it cannot be understood. The process detailed is thereby made as much a part of the invention as are the materials of which the product is composed. We shall not quote at large the description of the mode of making the plate. Such a quotation would unnecessarily prolong this opinion. *It plainly shows a purpose of the inventor to secure what had not been secured before,—a combination of a plate with artificial teeth, or with gums and teeth, in such a manner as to be free from the objections and defects or inconveniences attending the method before practised of attaching such teeth to a metallic plate fitted to the roof of the mouth.* Some of these objections are stated—such as expense, hurting the mouth, impeding mastication, and obstruction to perfect articulation. In carrying out the purpose proposed the materials employed were all old. The teeth, the wax, the plaster, the moulds, the soft rubber, and the hard rubber were none of them new. It is also true that the steps in the process were not all new. Plaster had been used for formation of moulds. The process of forming a plate by the use of such moulds was well known, and so was the process of converting a vulcanizable compound into vulcanite by heating it and *allowing it to cool in moulds.* But the process of Dr. Cummings extended beyond the use of known materials and the employment of the processes mentioned. It was vulcanizing soft rubber in a mould and in contact with artificial teeth inserted in place into it while it remained in a soft condition. It was well described by the Circuit Judge as "the making of a vulcanite dental plate out

of a vulcanizable compound, into which the teeth were imbedded in its plastic condition, and the rubber compound, with the teeth thus imbedded in it, afterwards vulcanized by heat, so that the teeth, gums, and plate should be perfectly joined without any intervening crevices, and the plate should possess the quality of hard rubber or vulcanite." The combination thus resulted in a manufacture which was "one piece." If, then, the claim be read, as it should be, in connection with the preceding part of the specification, and construed in the light of the explanation which that gives, the invention claimed and patented is "a set of artificial teeth as a new article of manufacture, consisting of a plate of hard rubber, with teeth, or teeth and gums, secured thereto in the manner described in the specification, by imbedding the teeth and pins in a vulcanizable compound, so that it shall surround them while it is in a soft state, before it is vulcanized, and so that when it has been vulcanized the teeth are firmly and inseparably secured in the vulcanite, and a tight joint is effected between them, the whole constituting but one piece." It is evident this is much more than employing hard rubber to perform the functions that had been performed by other materials, such as gold, silver, tin, platinum, or gutta percha. *A new product was the result, differing from all that had preceded it, not merely in degree of usefulness and excellence, but differing in kind, having new uses and properties.* It was capable of being perfectly fitted to the roof and alveolar processes of the mouth. It was easy for the wearer and favorable for perfect articulation. It was light and elastic, yet sufficiently strong and firm for the purposes of mastication. The teeth, gums and plate constituting one piece only, there were no crevices between the teeth and their supporters into which food could gather and where it could become offensive, and there could be no such crevices so long as the articles lasted. They were unaffected by any chemical action of the fluids of the mouth. Besides all this, they were very inexpensive as compared with other arrangements of artificial teeth. To us it seems not too much to say that all these peculiarities are sufficient to warrant the conclusion that *the device was different in kind or species from all other devices.* We cannot resist the conviction that devising and forming such a manufacture by such a process and of such materials was invention. More was needed for it than simply mechanical judgment and good taste. Were it not so, hard rubber would doubtless have been used in the construction of artificial sets of teeth, gums and plates long before Cummings applied for his patent. To find a material, with a mode of using it, capable of being combined with the teeth in such a manner as to be free from the admitted faults of all other known combinations, had been an object long and earnestly sought. It had been a subject for frequent discussion among dentists and in scientific journals. The properties of vulcanite were well known; but how to make use of them for artificial sets of teeth remained undiscovered and apparently undiscoverable until Cummings revealed the mode. But when revealed its value was soon recognized, and no one seems to have doubted that the resulting manufacture was a new and most valuable invention. The eminent dentists and experts examined in this case uniformly speak of it as such. Not one has ventured to testify that it was not an invention. They speak of it as "*a novel and desirable thing;*" as "*the greatest improvement in dentistry*" *made in many years;* and as an invention which is "*a great benefaction to mankind, whereby both health and comfort are promoted.*" The evidence also shows that it has wrought a revolution in dental practice, and that many thousands of operators are using it in preference to older devices. All this is sufficient, we think, to justify the inference that what Cummings accomplished was more than a substitution of one material for another; more than the exercise of mechanical judgment and taste,—that it was, in truth, invention. Undoubtedly the results or consequences of a process or manufacture may in some cases be regarded as

of importance when the inquiry is whether the process or manufacture exhibits invention, thought and ingenuity. Webster, on the subject-matter of patents, page 30, says: "The utility of the change, as ascertained by its consequences, is the real practical test of the sufficiency of an invention; and since the one cannot exist without the other, the existence of one may be presumed on proof of the existence of the other. Where the utility is proved to exist in any degree, a sufficiency of invention to support the patent must be presumed." We do not say the single fact that a device has gone into general use and has displaced other devices which had previously been employed for analogous uses, establishes in all cases that the latter device involves a patentable invention. It may, however, always be considered; and when the other facts in the case leave the question in doubt it is sufficient to turn the scale.

"We have, therefore, considered this branch of the case without particular reference to Hotchkiss *vs.* Greenwood, 11 How., 248 The patent in that case was for an improvement in making door and other knobs for doors, locks and furniture, and the improvement consisted in making them of clay or porcelain, in the same manner in which knobs of iron, brass, wood, or glass had been previously made. Neither the clay knob nor the described method of attaching it to the shank was novel. The improvement, therefore, was nothing more than the substitution of one material for another in constructing an article. The clay or porcelain door-knob had no properties or functions which other door-knobs made of different materials had not. It was cheaper, and perhaps more durable; but it could be applied to no new use, and it remedied no defects which existed in other knobs. Hence it was ruled that the alleged improvement was not a patentable invention. The case does decide that employing one known material in place of another is not invention, if the result be only greater cheapness and durability of the product. But this is all. It does not decide that no use of one material in lieu of another in the formation of a manufacture can, in any case, amount to invention or be the subject of a patent. If such a substitution involves a new mode of construction, or developes new uses and properties of the article formed, it may amount to invention. The substitution may be something more than formal. It may require contrivance, in which case the mode of making it would be patentable; or the result may be the production of an analogous but substantially different manufacture. This was intimated very clearly in the case of Hicks *vs.* Kelsey, 18 Wall., 670, where it was said 'the use of one material instead of another in constructing a known machine is, *in most cases*, so obviously a matter of mere mechanical judgment, and not of invention, that it cannot be called an invention, *unless* some new and useful result, as increase of efficiency, or a decided saving in the operation, be obtained." *But where there is some such new and useful result, where a machine has acquired new functions and useful properties, it may be patentable as an invention, though the only change made in the machine has been supplanting one of its materials by another. This is true of all combinations, whether they be of materials or processes.* In Crane *vs.* Price, 1 Webster's Patent Cases, 393, where the whole invention consisted in the substitution of anthracite for bituminous coal in combination with a hot-air blast for smelting iron ore, a patent for it was sustained. The doctrine asserted was that if the result of the substitution was a new, a better, or a cheaper article, the introduction of the substituted material into an old process was patentable as an invention. This case has been doubted, but it has not been overruled; and the doubts have arisen from the uncertainty whether any new result was obtained by the use of anthracite. In Kneass *vs.* The Schuylkill Bank, the use of steel plates instead of copper for engraving was held patentable. So has been the flame of gas instead of the flame of oil to finish cloth. These cases rest on the fact that a superior product has been the result of the substitution,—a product that has new capabilities and that performs new func-

tions. So in the present case, the use in the manner described, of hard rubber in lieu of the materials previously used for a plate produced a *manufacture long sought but never before obtained,—a set of artificial teeth,* light and elastic, easily adapted to the *contour* of the mouth, flexible, yet firm and strong, consisting of one piece, with no crevices between the teeth and the plate, impervious to the fluids of the mouth, unaffected by the chemical action to which artificial teeth and plates are subjected when in place, clean and healthy,—*peculiarties which distinguish it from everything that had preceded it.* These differences, in our opinion, are too many and too great to be ascribed to mere mechanical skill. They may justly be regarded as the results of inventive effort, and as making the *manufacture* of which they are attributes *a novel thing in kind, and consequently patentable as such.*

"A second objection urged by the defendant against the validity of the complainant's patent is alleged want of novelty of the invention; and a strenuous effort has been made to convince us that, *although hard rubber had not been used in the manner described for the production of the manufacture, equivalent materials and processes had been, and that a plate substantially the same as that of Dr. Cummings, had been made before his improvement.* We are not, however, convinced. The patent itself is *prima facie* evidence that the patentee was the first inventor, at least it casts upon him who denies it the burden of sustaining his denial by proof. *We do not find such proof in the case.* Though the patent was not granted until June 7th, 1864, the invention was completed at least as early as April 12th, 1855, when the application for a patent was made. Indeed, as we have noticed, a caveat to protect it was filed on the 14th of May, 1852, which clearly foreshadowed the invention. Yet taking the spring of 1855 as the time when it was completed, we find nothing in the proofs to justify a conclusion that Dr. Cummings was not the first inventor. It would answer no good purpose to review the voluminous evidence supposed to bear upon this branch of the case. We shall refer only to that which is deemed the most important and which has been most pressed upon us in this argument. Of the English patent of Charles Goodyear it is enough to say that, though the provisional specification was filed March 14, 1855, the completed specification was not until the 11th of September following. It was, therefore, on the last mentioned date that the invention was patented.

The experiments made by George E. Hawes, it must be admitted, *closely resembled the process described in the reissued patent to the complainants.* He cast in moulds sets of teeth on a tin base, *in a manner very like that in which the vulcanite plate is formed by the Cummings process.* But the experiments *resulted in nothing practical.* Hawes cast sets of teeth for the lower jaw only, the weight of the metal making the plate unfit for the upper. In consequence of the shrinkage of the metal in cooling, a tight joint could not be obtained between the teeth and the base. The sets were, therefore, liable to become offensive in consequence of deposits of food and the secretions of the mouth in the crevices. The shrinkage also prevented a close fitting of the plate to the roof of the mouth, and the tin base was affected by the chemical action of the secretions. In consequence of these and other objections the manufacture was soon abandoned, and it may properly be considered *an abandoned experiment.* It not only was not the same manufacture as that of Cummings, but it was not suggestive of it; and Dr. Hawes, who cast the tin plates, testifies that the use of vulcanite for dental purposes is the greatest improvement in his profession that he knew of in twenty-five years. He adds, that "*vulcanite may be used by dentists in many ways which could not be accomplished by tin or platinum.*" In his opinion, therefore, *the cast tin base was not substantially the same thing as the Cummings manufacture.* So, also, Dr. Royce, who cast plates of tin for artificial teeth in a manner very similar to

that of Dr. Hawes, testifies that the solid tin base was found practically unfit for the purpose, except in rare instances. He made but a few sets, none after 1850, and adopted the vulcanite, agreeing to pay for a license to use it in manufacturing dental plates.

We need go no farther into a consideration of the various devices and publications offered to show that the manufacture patented was known before Cummings invented it. *Suffice it to say, that none of them, in our opinion, suggest or exhibit in substance such a manufacture.* The defense of want of novelty is, therefore, not sustained."

The three paragraphs last quoted would seem to show conclusively, that this Court considered that the invention was not necessarily limited to a product made of vulcanite and a process involving vulcanization, but that if the defendant had succeeded in convincing this Court "that although hard rubber had not been used in the manner described for the production of the manufacture, *equivalent materials and processes had been, and that a plate substantially the same as Dr. Cummings' had been made, before his improvement,*" the patent would have been anticipated. This Court, after stating that *we shall only refer to that which is deemed most important*, and which has been most pressed upon us in this argument," discusses minutely the evidence relating to the cast tin base, and after admitting that the process of its manufacture was substantially like that of Cummings, disposes of both process and product by showing that the whole thing was an abandoned experiment, and that the product was substantially different from the vulcanite dental plate. This is the only thing earlier in date than Cummings' invention, that the Court deemed worthy of discussion.

The date of the invention is fixed by the decision of this Court in the Smith case as above quoted. (Brief p. 10.) The proofs bearing upon this point in this case, are the same as in that case.

THE QUESTION INVOLVED.

The only question involved in the present case, not disposed of finally by this Court in the Smith Case, is whether a set of teeth upon a base of "celluloid" made as described in the proofs, is an infringement of Reissued Letters Patent, No. 1904. In other words, is "celluloid" an equivalent of vulcanite when used as a base for holding artificial teeth, as described in the proofs?

This question was answered by the Court below in the negative.

GROUNDS OF DECISION OF COURT BELOW.

This decision was based upon the following propositions contained in the opinion of the Court (pp. 584, 585.):

1. That "celluloid" is a new material, discovered and patented since the date of Cummings' *invention*."

2. That in the manipulation of "celluloid" the process of making a set of teeth, composed of the plate and teeth and gums, is an entirely different process from that described in Cummings' patent, when compared with that part of the Cummings' process which was new in the state of the art, and the novelty of which part gave to the Cummings process, when considered as a whole, the ingredient of novelty and patentability.

3. That the celluloid is "not placed in the mould in a soft plastic condition a little at a time, *pressed in* with the finger, or *in any other convenient way*, but in a hard rigid condition like horn or bone or ivory."

4. "That the *use* of celluloid in the manufacture of sets of artificial teeth, as practised by the defendants, and *the manufacture itself, the set or plate of teeth* differ as much, both as to *process* and *product*, from the process and product described and claimed in the Cummings patent, as that process and that product differ from those previous manufactures which existed before the Cummings' invention, and were unsuccessfully relied upon as anticipating it."

We shall show that the first of these propositions is irrelevant, and that the others are erroneous.

SUBSEQUENT CONTRARY DECISION OF THE U. S. CIRCUIT COURT FOR THE SOUTHERN DISTRICT OF NEW YORK.

Subsequently the same question was presented to the Circuit Court of the United States for the Southern District of New York, in the case of the *Goodyear Dental Vulcanite Co., vs. Preterre* (15 Blatchf., 274). The proofs taken from the Smith case, which are in the present record, were incorporated by

stipulation into that case. That Court, in view of the decision of this Court in the Smith case (3 Otto, 486), was constrained to answer the question in the affirmative, and accordingly made a decree for a perpetual injunction, an accounting of profits and assessment of damages against the defendant, embracing his sets of teeth on the celluloid base.

DEFENDANT'S MANUFACTURE.

"Celluloid" is a substance capable of being formed into any desired shape by moulds at a temperature of from 270° to 300° F. (Plff's Ev., p. 44, 45, 104; Deft's Ev., p. 248), and is at ordinary temperatures precisely like vulcanite in respect to its hardness, strength, elasticity and capability of resisting fluids (Plff's Ev., pp. 53, 54).

"Complainant's Exhibit Hyatt, No. 1," is a "celluloid dental plate blank" commonly called a "celluloid dental plate" (Plff's Ev., p. 36.)

The defendant's method of using celluloid as a base for artificial teeth, and the properties of the substance for that purpose are clearly set forth in a circular of instructions issued by the Celluloid Manufacturing Company, printed on pages 38-45 of the record.

The instructions state (Plff's Ev., p. 41):

"In the process of making artificial dentures with the "celluloid base, the teeth, whether plain or in blocks, are "arranged on a base plate of wax or gutta percha, and invested "in the flask, with the best quality of plaster, *in the manner* "*usual where rubber is used*—except that the trial plate "should be much thinner, because celluloid is much stronger "than *rubber*."

Then follows certain directions for placing the plaster mould in the iron flask, so as to prevent danger of injury to the plaster, and for hardening the plaster.

"Around the outside of the teeth, about one-fourth of an "inch away, bevel the plaster back to the flask to receive the "excess of material. Do not cut gateways leading to the bev-"eled gutter; but leave the surrounding margin of one-fourth "of an inch to act as a back pressure on the celluloid during "the moulding process, so that *every part within the mould* "*and around the teeth and pins will be well and firmly filled*,

"and a *perfect adaptation of the celluloid to the teeth and the* "*mould* be secured.

"When the flask is thus prepared, select a plate of suffi- "cient size. not only to fill the mould, but to overflow in all "directions. This must be done to secure back or lateral pres- "sure from the mould, that the adaptation of the celluloid "may be perfect, and the pressure uniform and thorough in "all parts. If the plate selected does not approximate the "shape of the mould, *heat it in boiling water* and bend or trim "it to the proper shape." (p. 42.)

Then follows a description of the steam apparatus to be used in packing the plaster moulds with the celluloid made plastic by heat. It is the apparatus described in Hyatt's patent, No. 152,232, June 23, 1874 (p. 107), the use of which is admitted by the defendant in his answer (p. 21).

This consists of a small steam boiler in which is placed the "case" prepared precisely as if to be packed with rubber, a celluloid blank previously heated in boiling water (p. 42), so as to make it approximate the shape of the mould, being inserted between the two halves of the flask containing respectively the male and female plaster cast (pp. 42–3). When the heat reaches 270° F., pressure is to be applied until the two halves of the mould containing the plastic celluloid are brought completely together (p. 44.)

"As soon as the flask is closed, turn off the gas or extin- "guish the alcohol, and raise the safety-valve for the escape of "the steam for the purpose of reducing the temperature, and "then allow the boiler, flask and contents to become thoroughly "cold before relieving the flask from pressure ; but do not has- "ten the cooling process" (p. 44).

The circular also contains the following, among other references to the manufacture of sets of teeth on the vulcanite base (pp. 39-40).

"We have made no statement here but which has been fully "considered, and we say without hesitation, that *with the* "*same care that is required to succeed with a rubber plate*, "success with the celluloid is certain. It is true, that a little "experience is necessary, as *the manipulation is a little* "*different* from that required in *working rubber*, but the "printed directions sent with each apparatus will generally "suffice to make all plain, if they are carefully observed. "There are few persons, however, upon which a little more

" detailed explanation might be useful. *If too great a degree* " *of heat is used* whilst pressing the plate, it will come out of " the flask porous, *just as rather thick masses of rubber, will*, if " they are *vulcanized at too great a heat.* * * * * * *

" Its durability has been tested to such an extent that there " can be no question but that it is *fully as lasting as rubber*, and " nothing remains to be done so far as the establishment of its " entire reliability is concerned. For *regulating plates*, and in- " deed, *in every place where rubber as a vulcanite can be used*, " celluloid may with advantage *be substituted for it.* As there " are no patents which lie in the way of its universal use, we " commend it with confidence to the dental profession."

A regulating plate is a plate without teeth, used to press natural teeth into symmetrical or proper position, and depends upon its elasticity for its usefulness.

The Celluloid Dental Plate, or set of teeth on the celluloid base, is the product of this process.

Complainant's Exhibits "Hyatt No. 3" and "Hyatt No. 4" (Plff's Ev., p. 37) are celluloid sets of teeth. We ask the Court to compare these two Celluloid Exhibits with "Complainant's Exhibit Hyatt No. 5" (Plff's Ev., p. 37) and Complainant's Exhibit Vulcanite Partial Plate (Plff's Ev., p. 185) and then to compare these four Exhibits with Dr. Wildman's Defendant's Exhibit, E, W, No. 13 the set of teeth upon a base of silver and cast tin (Deft's Ev., p. 347), bearing in mind the fact that *of all the preexisting things proved in this case, this is the one that most closely resembles the thing covered by the patent.*

It is true that Cummings and the defendant both use the Wildman plaster moulds, and that the upper plaster section is the same in all three processes, but the lower plaster section in the Wildman process contains the plate proper formed of a sheet of gold or silver by swaging in a die and counter die, while in both the Cummings and celluloid processes the lower section contains nothing, leaving the entire cavity between the plaster sections to be filled by the plastic material, which on hardening is to become the elastic base to hold the teeth.

After an examination of these exhibits it will not appear surprising that *even the patentee of the celluloid base* who is also the managing manufacturer for the Celluloid Manufacturing Company, the real defendant, when called as a witness for the plaintiff, to prove infringement, *was unable to distinguish a set*

of teeth on the celluloid base, of his own manufacture, from a vulcanite dental plate (Plff's Ev., pp. 37-38).

THE NEW YORK CASE COMPARED WITH THIS CASE.

The facts upon which the Circuit Court in New York based its conclusion, that the complainants were entitled to a decree, are precisely the same as those established by the evidence in this case, as we shall show beyond the shadow of a doubt, with only a single exception, which is, that in the Preterre case the plaintiffs were able, on the cross-examination of the defendant's chemical expert to prove that celluloid, or solid collodion was, within his personal knowledge, a known substitute for vulcanite prior to the date of the plaintiffs' *invention.* This proof does not exist in this case. We propose to show the Court that this difference in the proofs is entirely immaterial, and also that the conclusions of the Circuit Court in New York are well-founded in law, while those of the Court below are erroneous in law, and founded upon an assumed state of facts, for which there is no warrant whatever in the evidence. We can, perhaps, most succinctly state the questions involved, and our general position in reference to them, by quoting in full the comparatively short opinion of the United States Circuit Court for the Southern District of New York, where it refers to this general subject (15 Blatchford, p. 277).

OPINION OF THE CIRCUIT COURT IN NEW YORK HOLDING CELLULOID TO INFRINGE.

"The defendant is shown to use celluloid and rose pearl in the manner described by the witnesses, in making dental plates. He relies largely upon the decision in Goodyear Dental Vulcanite Co. *vs.* Davis, (12 Pat. Off. Gaz., 560,) by the late learned Circuit Judge Shepley, in the District of Massachusetts, in support of the position that the use shown in this case is not an infringement. If that case was exactly like this it should and would have great and controlling weight in the decision of this, both on account of the eminent learning and ability of the Court making the decision, and because the same

rule ought to prevail throughout the country in respect to infringements of the same patent by the same means, as well as upon other questions in respect to other subjects, as was so well expressed by the late learned Circuit Judge Emmons, in Goodyear Dental Vulcanite Co. *vs.* Willis, (7 Pat. Off. Gaz., 41-44.)

"But this case upon the evidence here is not like that before Judge Shepley, *as the facts are stated in his opinion to have appeared there.*

"The patent may well be considered to be established as valid everywhere, but whether parties have infringed it in particular cases must depend upon the proof in each case. The owners of the patent may be able to prove infringement in one case and not in others; but, proving it infringed in one case will not show that all others charged to be infringers are so, nor will failure show that none others charged are so. It is only when the facts of the cases are alike that one ought to control another.

"In that case the question was whether the patent for a plate of teeth made of rubber, compounded with sulphur and subjected to heat to harden it, would be infringed by plates of teeth made of celluloid, shown to be, 'a new material discovered and patented since the date of 'Cummings' invention,' in the manipulation of which, '*the process of making a set of teeth composed of the plate, and teeth, and gums is an entirely different process* from that described in the Cummings patent, when compared with that part of the Cummings process which was new in the state of the art, and the novelty of which part gave to the Cummings process, when considered as a whole, the ingredient of novelty and patentability;' when it was '*not placed in the mould, in a soft, plastic condition*, 'a little at a time, *pressed in* with the finger, *or in any other convenient way*,' but in a *hard, rigid condition*, like horn, or bone or ivory,' and 'then subjected to heat, not to vulcanize or harden, but to soften it;' and which, 'afterwards, on being cooled or restored to its original temperature, returns to its original condition, as a hard substance, as when first placed in the mould;' from which it appeared 'evident to the Court that the use of' the celluloid, in the manufacture of sets of artificial teeth, as practiced by those defendants, and the manufacture itself, *differed*, 'as much, *both as to process* and *pro-*

duct, from the *process* and *product* described and claimed in the Cummings patent, *as that process* and *that product differed from the previous manufactures which existed before the Cummings invention*, and were unsuccessfully relied upon as anticipating it.'

In this case, it appears from the evidence, that the celluloid and rose pearl in use by the defendant, whether actually the same as that material in that case or not, were well known at the date of that invention; and, from the testimony of the defendant's witness Fisk, that, in use, it is softened in boiling water, and made plastic before it is put into the moulds; and from the defendant's witness Parmelee that vulcanized rubber is soft when hot, and becomes hard by cooling; and also, from the witness Fisk, that the means employed for fastening the teeth to the plate are the same in respect to each substance, and that when the celluloid plate is completed, 'its structure is precisely the same as that of a vulcanite dental plate, except that the base of one is made of celluloid and the other of vulcanite,' and that they are so much alike that any one might mistake one for the other, and patients seldom notice the difference.

"It is obvious, from this statement, that this case, upon its facts, is radically different from that, and should not be controlled by the decision there, further than the same principles are applicable to both.

"That decision does not seem to proceed exactly upon the ground that there could be no equivalent for vulcanite, but rather upon the ground that what was claimed to be an equivalent was not in fact so.

"*The invention seems to be, of a combination, in a dental plate, of the plate proper, holding the teeth imbedded into it, and made fast in the mode described, with the teeth themselves. The material for the plate is of chemical formation, but the operation of the plate, when formed, is mechanical. The teeth are the main object. The plate is for the purpose of holding them in the right position in respect to the mouth. It is held in place itself principally by atmospheric pressure, and holds the teeth in place by its mechanical strength. The rubber plate is very useful for this purpose, on account of its lightness, slightly yielding rigidity, and capability of the material for being fitted into the moulds when soft and becoming hard in*

exactly the shape of the moulds without shrinking. The celluloid shown here appears to have the same qualities and capability in these respects. The mode of taking the impression of the mouth, and making moulds for the plate and teeth, of plaster, by using wax, was old. Rubber, the mode of vulcanizing it, and vulcanite itself, were old. Moulding vulcanite into shapes wanted was old. *Cummings invented combining it, when hot and plastic, with artificial teeth, by moulding it about them in their proper position, so that the whole would be in the required shape and relative position, in one solid piece, when the rubber should become hard.* Celluloid was old. *The defendant, with moulds made by the same methods as Cummings', combines that with artificial teeth, by moulding it about them when hot and plastic, so that the whole will be in one piece in the required shape, with the teeth in their proper position when it becomes hard*; and, when *the products* of these processes are done, they are *so near alike that persons using them do not distinguish one from the other.* The celluloid is, for this purpose, clearly a mechanical equivalent of the vulcanite. Chemically, they are, in some respects, different, but in all that are of any importance, for the purposes they are here wanted for, they are the same. They burn differently but they are not wanted for burning. They come to the plastic state, in which they can be put into the moulds, by chemical and widely different processes. The process by which they are converted, from masses in that state, into finished dental plates, so inheres in the product that it is said to give distinctive character to it. That process begins with the moulding. The point is not, whether the substances were ever equivalents for these, or any other, purposes before, but whether they are equivalents for this purpose then, and it seems that they are.

"It is said by Mr. Justice Clifford, in Gould *vs.* Rees, (15 Wall. 187, 194,) and in Gill *vs.* Wells, (22 Wall., 1,) that inventors of a combination are as much entitled to equivalents as the inventors of other patentable improvements, if the equivalents were known to be such at the date of the *patent.* Judge Shepley, in Goodyear Dental Vulcanite Co. *vs.* Davis, before mentioned, either intentionally or inadvertently, said, in respect to the same thing, 'the date of the *invention.*' Some question has been made about which date controls, if either does absolutely. "Perhaps it is the date of the patent because the patent is a

grant and, as such must speak from its date. But, whichever date should control, or whether either should, is not material in this case, for the evidence is full that celluloid and rose pearl, with their moulding and other qualities useful to this manufacture, were well known at both dates.

"Under the reasoning of the Court in Goodyear Dental Vulcanite Co. *vs.* Smith, (93 U. S., 486), in which the validity of the patent was held, if Hawes, there mentioned had been shown to have used celluloid or rose pearl, as the defendant now uses them, instead of tin, as he was shown to have used that, in making dental plates, the patent could not have been maintained. He would have been entitled to the patent instead of Cummings. "Celluloid itself may be patentable and patented, but the use of it in this manner, in the formation of dental plates, could not be, in the light of Cummings' invention; and, whether the invention of this use of them would be patentable in the view of the other patent, is one accurate test of whether it is an infringement of that patent. (Curtis on Pat. §§ 321 to 323. Walton *vs.* Potter, 4 Scott, N. S., 91.)"

The Hawes cast tin base referred to, is thus spoken of in the opinion of this Court, (3 Otto, p. 498) which we have already quoted: "The experiments made by George E. Hawes, "it must be admitted, *closely resembled the process described* "*in the reissued patent to the complainants.* He cast in "moulds sets of teeth on a tin base, *in a manner very like that* "*in which the vulcanite plate is formed by the Cummings* "*process.* But the experiments resulted in nothing practical." * * * "The manufacture was soon aban- "doned, and it may properly be considered an *abandoned ex-* "*periment.*"

Assignment of Errors.

1. The Court below erred in holding that celluloid sets of teeth made as described in the proofs incorporated by stipulation into this case, and admitted to have been made by the defendant (pp. 31, 32), did not infringe the complainant's patent, Reissue No. 1,904.

2. The Court below erred in dismissing the complainant's bill, and in not granting to the complainant the relief prayed for by the bill.

POINTS OF LAW AND FACT.

In support of our contention, that the decree of the Court below should be reversed, we shall discuss the following propositions :

1. An inventor is only required to describe in his specification the exact thing invented by him, and a practicable way of making or constructing it. The law protects him from imitation by the use of equivalents, and to this end the patent is to be liberally construed in the light of the state of the art, which alone can limit the range of equivalents by compelling a narrow construction of the patent.

2. Unsuccessful and abandoned experiments, and useless and impracticable manufactures, form no part of the state of the art.

This eliminates from the case—

(*a.*) The cast tin process, and product of Hawes and of Royce.

(*b.*) The manufacture of sets of teeth, involving the use of unvulcanized gutta percha.

3. The state of the art is fully shown in the following manufactures :

(*a.*) The gold or silver plate with teeth riveted to it, formed into shape by hammering between a die and counter die.

(*b.*) The platinum or continuous gum set, constructed like the gold or silver plate, but having porcelain paste gums baked successively in layers around the roots of the teeth.

(*c.*) The Wildman gold or silver plate, with gums of pure tin cast in a plaster mould around the roots of the teeth, and

upon the adjoining surface of the plate, thus securing them as by soldering.

4. Vulcanite and its properties, including its water-proof character, its capacity of being formed accurately to the shape of a mould, its lightness and its elasticity and hardness at temperatures far above that of the human mouth, were well known before Cummings' invention. So was the process of moulding the vulcanizable compound in moulds, and converting it into vulcanite by heating it and allowing it to cool in the moulds. It was also well known that the compound when packed must be made plastic by heat, and that vulcanite remained soft while hot and hardened only on cooling. It was therefore not necessary for Cummings to describe accurately the method of forming vulcanite in moulds. His reference in his specification to the vulcanite art imports into it all that was known in that art.

5. The Cummings patent describes—

(*a*) *A new process* whereby the Wildman plaster mould, with the teeth in position, is packed with plastic rubber compound, occupying the whole interior of the plaster mould, as well the part of the cavity, bounded by the plaster contour of the plate proper, as the part of the cavity corresponding to the gums or alveolar ridge, so that on the hardening of the substance forming the plate and gums, or "base," in the way well known to those skilled in the art of forming vulcanite in moulds, the "teeth plate and gums will all be connected forming as it were one piece"—thus dispensing with the formation of a die and counter die, and a silver or gold plate swaged as nearly as possible into shape between them.

(*b.*) *A new product*, strikingly different from the metal plates in previous use, consisting of a set of artificial teeth combining the properties of lightness, elasticity, perfection of fit by moulding, and cleanliness, fully described by this Court in its decision in the Smith case 3 Otto, at pages 494 and 497.

6. Celluloid is a water-proof substance that is precisely like vulcanite in respect to the qualities that characterize Cummings' product, viz: lightness, elasticity and hardness, at temperatures far above that of the human mouth, and capacity of being

formed in plaster moulds so as to produce perfection of fit and close adaptation to the teeth.

7. The defendant, with moulds made by the same method as Cummings', combines celluloid with artificial teeth, by moulding it about them, when hot and plastic, so that the whole will be in one piece, in the required shape, with the teeth in their proper position, when it becomes hard; and when the products of this and the Cummings process are done, their mechanical structure is identical. They are so nearly alike that they can hardly be distinguished the one from the other, the resemblance being so exact as to deceive the very inventor of the celluloid base for artificial teeth.

8. The celluloid is, for this purpose, clearly the mechanical equivalent of the vulcanite.

9. For the purposes of this case, it it is immaterial whether celluloid was known or unknown at the date of Cummings' original patent. The doctrine of Gill *vs.* Wells (22 Wall, 1), that a substitute for an ingredient in a combination must be a known equivalent at the date of the patent to constitute substantial identity between the combinations, has no application to the case of a bare substitution of one material for another, without any resulting difference of function or effect.

10. "Celluloid" is a trade mark name for solid collodion, which was a known elastic water-proof substance, capable of being made plastic and moulded in plaster moulds by the aid of heat, and well known long prior to the date of Cummings' original patent as a substitute for vulcanite for the purposes of dentistry, button manufacture and almost every conceivable general purpose in the arts.

11. To substitute "celluloid" for vulcanite in this combination required the exercise of the merest mechanical judgment. It was the bare substitution of one material for another without any new result. "Celluloid itself may be patentable and patented, but the use of it in this manner, in the formation of dental plates, could not be in the light of Cummings' invention; and, whether the invention of this use of them would be patent-

able in view of the other patent, is one accurate test of whether it is an infringement of that patent."

12. The patentee having invented and claimed a new article of manufacture—"a novel product"—is entitled to protection against the unauthorized use of a substantially similar article, independent of the question whether the process by which it is produced is the same or different from the process described in the patent.

13. Not only is the product the same, but the process is substantially the same; it is the process common alike to the manufacture of a set of teeth on the vulcanite base, the celluloid base, and the cast tin base, described in the opinion of this Court, (3 Otto, p. 498), with this exception, however, that in casting tin no pressure could be employed to ensure a perfect fit, and close contact of the base with the teeth, while the packing by pressure of the moulds holding the teeth in position is an essential feature of both the vulcanite and celluloid processes.

14. The claim of the patent "The plate of hard rubber or vulcanite, or *its equivalent*, for holding artificial teeth or teeth and gums, substantially as described," is, for these reasons, infringed by the plate of celluloid for holding artificial teeth or teeth and gums, as constructed by the defendant.

15. Nothing contained in the correspondence between the Commissioner of Patents and the patentee, in the record of the proceedings in the Patent Office, antecedent to the grant of the patent, could limit the patentee to vulcanite, and deny him protection against equivalents.

(*a.*) Such evidence is not admissible to vary the construction of the patent finally granted.

(*b.*) There is nothing in the proceedings in the Patent Office that by any fair construction could, if admissible, restrict the scope of the patent.

I.

An inventor is only required to describe in his specification the exact thing invented by him, and a practical way of making or constructing it. The law protects him from imitation by the use of equivalents, and to this end the patent is to be liberally construed in the light of the state of the art which alone can limit the range of equivalents, by compelling a narrow construction of the patent.

In *Crosley* vs. *Potter*, Pollock, C. B., says: "In my mind "the safest course for patentees to adopt in framing their spe- "cifications is, instead of including everything, to confine "themselves specially to one good thing, and a jury will al- "ways take care that, if that be a real invention, no man, "under color of improvement, shall be allowed to interfere "with that which is the offspring of their genius." (Macr., P. C., 256.)

The plaintiff's re-issue is framed strictly upon this principle.

Patents for invention are to receive a liberal interpretation, and are if practicable to be so construed as to uphold and not to destroy the right of the inventor.

Goodyear D. V. Co. *vs.* Gardner, 4 Fisher, 227.
Turrill *vs.* Michigan S. & N. R. R. Co., 1 Wall., 491.

In Ames *vs.* Howard (1 Sum., 485), Mr. Justice Story says that "it has always been the course of the American Courts (and it has latterly become that of the English Courts, also) to construe these patents fairly and liberally, and not to subject them to any over nice and critical refinements."

In *Roots* vs. *Hyndman* (6 Fisher, 440, 443, 444), the Court (Swayne, Emmons and Swing, *JJ.*) says:

"The benefits clearly perceived as resulting from the inven- "tion impose upon the Court the duty of avoiding, if possible, "an interpretation which will hand them all over to an in- "fringer."

The general principles of law in relation to what constitutes an infringement, are familiar to this Court, but it may not be

out of place to refer to some of the reported cases. These principles are well summarized by Mr. Justice Hunt, in delivering the opinion of this Court in a recent case, as follows:

"To constitute an infringement, the thing used by the defendant must be such as substantially to embody the patentee's mode of operation, and thereby to attain the same kind of result as was reached by his invention. It is not necessary that the defendant should employ the plaintiff's invention to as good advantage as he employed it, or that the result should be the same in degree, but it must be the same in kind. (Winans *vs.* Denmead, 15 How., 330.)

"To infringe a patent, it is not necessary that the thing patented should be adopted in every particular. If the patent is adopted substantially by the defendants, they are guilty of infringement. (Root *vs.* Ball, 4 McLean, 177; Alden *vs.* Dewey, 1 Story's C. C., 336.)

"In an action for infringement, the first question is, whether the machine used by the defendant is substantially, in its principle and mode of operation, like the plaintiff's. If so, it is an infringement to use it. (Howe *vs.* Abbot, 2 Story's C. C., 190; Parker *vs.* Haunth, 4 McLean, 370.)

"If he has taken the same plan and applied it to the same purpose, notwithstanding he may have varied the process of the application, his manufacture will be substantially identical with that of the patentee. (Curtis, § 312.)

"Erskine, *J.*, says in Walton *vs.* Potter, Webs. Pat. Cas., 585, 607, the question of infringement depends upon whether the plan which the defendant has employed is, in substance, the same as plaintiff's, and whether all the differences which have been introduced are not differences in circumstances not material, and whether it is not, in substance and effect, a colorable evasion of the plaintiff's patent.

"When a party has invented some mode of carrying into effect a law of natural science, or a rule of practice, it is the application of that law or rule which constitutes the peculiar feature of the invention. He is entitled to protect himself from all other modes of making the same application, and every question of infringement will present the question whether the different mode, be it better or worse, is, in substance, an application of the same principle. (Curtis, § 320.)"

Sewell *vs.* Jones, 1 Otto, 183-4.

In Cochrane *vs.* Deener, 4 Otto, 789, this Court held, reversing the decision of the Supreme Court of the District of Columbia, that the first claim of Cochrane's re-issue No. 6,594, for a combination, comprising a certain flour bolting apparatus, was infringed by the defendant's bolting apparatus, the Court saying: "Though some of the corresponding parts of the machinery designated in this combination are not the same in point of form in the two bolting apparatuses, and *separately considered, could not be regarded as identical or conflicting*, yet having the *same purpose in the combination*, and effecting that purpose in substantially the same manner, they are the equivalents of each other in that regard."

Mr. Justice McLean said (*Pitts* vs. *Edmonds*, 2 Fisher, 52): "Now a patent, in calling for a specific mode, embraces, in law, all mechanical equivalents or modes which operate on the same principle; consequently all modes, *however changed in form*, which act substantially on the *same principle*, and *effect the same end*, are within the patent. If this were not so, a patent right would be of no value, as it *might be avoided by any one who possessed ordinary mechanical skill*" (p. 57–58).

Judge Woodruff said (*Wheeler* vs. *Clipper Mower and Reaper Co.*, 6 Fisher, 26): "A device is not less an equivalent of another merely because superadded to all the functions of such other, it may perform a further office; still less does it fail to be the equivalent of another because, besides all the functions of such other, it performs some one of the offices more effectively or better, so long as it performs them in substantially the same way, and uses substantially the same means."

In *Welling* vs. *Rubber Coated Harness Trimming Co.* (7 Off. Gaz., 606,) "where a patentee described a martingale-ring formed by enveloping a metal ring, by means of dies, with a plastic composition known as 'factitous ivory,' or 'any similar compound,' the claim being for 'the ring for martingales,' &c., manufactured as set forth, with a metal ring enveloped in composition, as and for the purposes specified," it was held that "the patent would include the application of hard rubber to a metal ring by means of dies."

"The fact that the rubber must necessarily undergo the additional process of vulcanization does not exempt it from the control of the patent. *Though not the same substance, in its essence and constituents, as the 'factitious ivory,' it is a simi-*

lar material as regards its capability of being adapted to the purposes for which the latter is used."

This case was reversed in this Court, but upon a point in nowise affecting the question of infringement. (7 Otto, 7.)

Thus it was held by Judges Nelson and Shipman, that "a patent for the use of oil or equivalent substance, to prevent the gum from sticking to the moulds during the process of vulcanization and to aid in the expulsion of air, is infringed by the use of spirits of turpentine, if the latter substance accomplished the same results in the same way, and by *substantially the same properties of matter in the material used.*

In the same case, it was held that Meyer's patent, for the application of tinfoil for the purpose of preserving the shape of vulcanite compound during the process of vulcanization, embraces the "use and application of *all metal plates that are sufficiently flexible* to be used in substantially the same way, with substantially the same results that tin foil could be used." (*Poppenhusen* vs. *Falke*, 2 Fisher, 213.)

Thus, in *Roberts* vs. *Roter*, 5 Fisher, 296, the plaintiff had a patent for exploding torpedoes in oil wells *under water*. The defendant did not use water as a tamping agent, but substituted benzine for that purpose. The Court (McKennan, *J.*, with the concurrence of Mr. Justice Strong) held that "the use of benzine or any other substance, possessing *that property of water* which is made available in the patentee's process, is within the scope of the patent as a manifest equivalent."

The case of *Roots* vs. *Hyndman*, 6 Fisher, 439, before Judges Swayne, Emmons and Swing (1873), arose on a patent for an "Improvement in cases for Rotary Blowers," containing the following claims:

1. "A Rotary blower case, the interior of which is rendered true and accurate by means of plaster of Paris, or its described equivalent, applied substantially as described."

2. "A Rotary blower case, the ends or heads of which are rendered true and accurate by means of plaster of Paris, or its described equivalent, applied substantially as described."

3. "A Rotary blower case, the concaves or arcs of circles of which are rendered true and accurate by the use of plaster of Paris, or its described equivalent, applied substantially as described" (p. 440.)

The defendant used glycerine and litharge instead of plaster of Paris. This was held to be an infringement, because the substance used by the defendant, "*possessed the property of being rendered plastic for the purpose of application in the described mode, and of hardening or ceasing to be plastic in such conditions and in such time as accomplishes the purpose desired. It does not refer to the chemical constituents of the material. They are indifferent to the objects aimed at, and cannot be supposed to have been in the mind of the patentee. Nor do we think the description of the mode in which the substance is to harden 'by the evaporation or fixation of its water,' confines complainants to substances which are hardened in that way only*" (p. 441).

This case was appealed to this Court and the decree below affirmed, the principle upon which the decision was founded, being deemed so plain that the following is the entire headnote of the case:

"This case involves merely questions of fact; and the Court finds that Letters Patent No. 106,105, granted August 9, 1870, to William G. Hyndman, for an "improvement in rotary blowers" infringe the first, second, third and fourth claims of reissued Letters Patent No. 3,570, granted July 27, 1869, to P. H. Roots and F. M. Roots, for "an improvement in cases for rotary blowers," upon the surrender of original Letters Patent No. 80,019, dated August 11, 1868."

Hyndman *vs.* Roots, 97 U. S., 224.

Judge McKennan said (Union Paper Collar Co. *vs.* White, 7 Off. Gaz. 700): "Characteristic resemblance is the fairest test of substantial indentity."

II.

Unsuccessful and abandoned experiments and useless and impracticable manufactures form no part of the State of the Art.

This eliminates from the case.

(a.) The cast tin process and product of Hawes and of Royce.

(b.) The manufacture of sets of teeth involving the use of unvulcanized gutta percha.

The general proposition of law above stated is too familiar to require discussion.

THE CAST TIN BASE.

The evidence bearing upon the cast tin base, consists only of the evidence in the Smith case, upon which this Court held it to be an abandoned experiment.

Smith vs. Goodyear, D. V. Co., 3 Otto 498, 499.

THE GUTTA PERCHA BASE.

Caoutchouc and gutta percha are both vulcanizable gums capable of being made into vulcanite by heating with sulphur (Plff's Ev., pp. 74, 57; Deft's Ev., p. 245, Q. 79. 422)

Gutta percha is not an elastic substance in the sense in which vulcanite is elastic (p. 176, Q. 7, p. 79, 58 X-Q 22), as will appear evident on a comparison of "Exhibit Roby Vulcanite" with "Exhibit Roby Gutta Percha." (P. 176.)

The proof relating to gutta percha as a base for artificial teeth, prior to Cummings' invention, consists of certain English and French publications, an English patent of Truman, and an alleged use by Asa Hill, at Norwalk, Conn.

The following are the publications.

Great Exhibition of the Works of Industry of all Nations. Catalogue, 1851. (Deft's Ex. 49, p. 560.)

Mere mention of set of teeth mounted on gutta-percha, E. Truman, inventor. (H. B. Renwick, p. 78.)

Report of Juries. Exhibition of 1851. London, 1852. (Deft's Ex. 50, p. 560.)

A statement that Mr. Truman had discovered that a lump of "gutta-percha moulded into the form of a jaw-bone" had been found capable of holding artificial teeth. (H. B. Renwick, p. 78.)

American Journal of Dental Science. January, 1852. (De-Deft's Ex. 51, p. 560.)

Statement that Mr. Parsons had a set of teeth, the entire base of which was composed of a preparation of gutta-percha, and that he does not regard the material as suitable for the purpose, and says: "It can never supersede well adapted gold plates or carefully (prepared) sea-horse ivory foundations. (H. B. Renwick, p. 79.)

Comptes Rendus Hebdomadaires des Séances de l' Academie des Sciences, 1851. (Deft.'s Ex. 52, p. 561–2.) This has been usually spoken of in these cases as the Delabarre publication.

A suggestion, by Delabarre, for making a dental plate of gutta percha by forming it while warm upon a plaster model of the mouth. After the plate is thus made, the teeth are fixed into it by means of staples or metal *crampons*, applied hot.

It is obvious that this exhibit does not describe or suggest an article of manufacture in any way similar to what is described and claimed in the Cummings reissue. It is also proved, without contradiction, that this exhibit does not give such directions as to have enabled a dentist of ordinary skill in 1851 to construct from it a practically useful dental plate; and also, that it is impossible for a dental plate constructed according to its directions to be a practically useful set for the purpose of mastication. (Plff's Ev., Flagg, p. 114, Int. 51–55; p. 122, Cross-int. 196. Rushmore, p. 146, Ints. 22–27, and Exhibit Rushmore, No. 2. H. B. Renwick, pp. 79, 58, X-Q. 22.)

Gutta percha is not capable of resisting the action of the fluids of the mouth. It speedily becomes offensive. (Flagg, p. 113–114, ints. 47-52. Rushmore, p. 154–155, ints. 141, 142.)

At the temperature to which it is exposed in the mouth, it becomes too soft to enable it to hold the teeth, or retain its shape. In fact it is plastic at so low a temperature, that it is usually moulded with the thumb and fingers. (Deft's Ev., p. 527, Deft.'s Ex. 48, p. 560. Ex. 22, pp. 504, 506. Plff's Ev., Flagg, pp. 113, 114, Ints. 45, 53, 54; p. 123, Ints. 204, 205. Rushmore, p. 147, Int. 26, 27. H. B. Renwick, p. 58, X-Q. 22, p. 79).

It is used by dentists as a substitute for wax (Plff's Ev., p. 113, Q. 45, 46, p. 123, Q. 204, 205, Deft's Ev., p. 473), and it can be moulded upon the mouth itself (Deft's Ev., p. 525).

Henry B. Renwick shows that there is no foundation for the suggestion, founded upon a loose translation, that this Delabarre publication mentions a plaster mould in two parts of any kind, much less the one employed by Dr. Cummings (p, 79).

He also says of this Exhibit (p. 58) :

Cross-Q. 22. In what does the Delabarre set of unvulcanized gutta percha differ from a Cummings set of teeth, as an article of manufacture, aside from the fact of its being unvulcanized.

"A. The great difference between the two sets is that the Cummings set is exceedingly useful, and that the Delabarre set is good for nothing ; which fact I have ascertained by experiment. *The crude gutta percha is not in any sense an equivalent of vulcanite,* as it has neither its elasticity, its hardness, or its tenacity ; and it is incapable of so holding the teeth that they can be used for the ordinary purposes of mastication ; it cannot so hold them, even when at the ordinary temperature of a room, and it supports them much more feebly and imperfectly when at the ordinary temperature of the mouth. Teeth stuck in a plate of putty made to fit the shape of the mouth, would, in one way of looking at the matter, differ from a Cummings set only in the fact that putty was used instead of vulcanite ; but I should say that when the two things were completed they were entirely different. The difference between the sets referred to in the question would arise from the fact that the crude gutta percha was used in one, and vulcanite in the other."

E. T. Truman, English Patent, 1848. (Def't.'s Ex. 12, p. 471.)

This is a skeleton plate, or rather frame, of metal, surrounded by gutta percha or wax, which is thickly gilded, and having pins soldered to the metal which extend into sockets left to receive the teeth. The last step in the process is to insert the teeth into the sockets, and to cement them upon the pins. It is stated also that the gutta percha need not be gilded.

As the gutta-percha would soften at the temperature of the mouth, and as it possessed none of the elasticity of vulcanite, and as, if not gilded, it would speedily become offensive under the action of the fluids of the mouth, it is obvious that the objects in view were not attained by this plan. (Deft.'s Ex. 12, p. 473; Ex. 42, p. 525 ; also article at p. 527. Ex. 48, p. 560 ; Ex. 64, p. 428 ; Ex. 22, pp. 504, 506, 507. Flagg, p. 113, Q. 46.)

Dr. Asa Hill, of Norwalk, Ct., testifies that in 1851 he constructed dental plates of a *secret compound*, which he says was composed of gutta percha and some metallic salt, by forming a dental plate of the compound and then heating the teeth and pressing them into it (Hill, pp. 363–365 ; p. 374, Cross-ints. 101, 102).

This secret compound softened at about the temperature of the mouth. (See his article, Deft.'s Ex. 42, p. 527; Hill, p. 374, Cross-int. 100.)

It also proved incapable of resisting the fluids of the mouth (Ex. 42, p. 528).

This was also an unsuccessful and *abandoned experiment* (Hill, p. 363, 364, Int. 8–9 ; p. 367, Cross-ints. 1 to 6 ; p. 368, Cross-ints. 15–17 ; Cross-int. 20 ; p. 373, Cross-ints. 84–90 ; p. 374, Cross-ints. 96–98 ; p. 375, Re-cross int. 4).

Dr. Hill had also failed, prior to November, 1853, in an attempt to make dental plates of pure gutta percha, constructed on a frame of silver, in a manner somewhat similar to that described in the Truman patent (pp. 471–474), already referred to (Hill, p. 365, Int. 21. Deft.'s Ex. 42, p. 527.)

One remark is applicable to all these gutta-percha experiments. It never occurred to any of these experimenters to form the base by using a plaster mould in two parts, one of which should hold the teeth.

The only attempt to meet the overwhelming evidence, introduced by complainant, to show the impossibility of using gutta percha as a base for artificial teeth, is found in the evidence of defendant's witness, Dr. Alfred Starr (pp. 239–245). This witness claims to have made "temporary sets" of teeth on a gutta percha base, beginning *twenty years ago* (1856), subsequent to Cummings' invention (p. 240, Q. 10). This testimony could be of no pertinence except to prove that the Delabarre publication describes a practical and useful thing. Starr got from defendant's counsel some peculiar teeth with broad, flat, button-like bases, the like of which were never before seen (see Defendant's Exhibit No. 35, pp. 243–244), and inserted them into a gutta percha base with the result shown in "Defendant's Exhibit No. 33." And he thinks that this extraordinary structure would have "sufficient strength for use in the mouth" "*for a while*" (p. 241 Q. 24). This "Exhibit No. 33" has been put before the Court as illustrating the practicability of the thing described by Delabarre, although the witness himself swears that the mode described in Delabarre's publication is not the same as that which he practiced for setting the teeth in the gutta percha base (p. 243, X-Q. 56), and notwithstanding the fact that before the witness was called, *he had told the learned counsel that he did not consider that gutta percha could be used for the purposes of making a practically useful permanent set of teeth.* (p. 244, X-Q. 72–75).

We may dismiss from further consideration the gutta percha sets of teeth, which are proved in this case, as they have been in the previous cases, to be utterly useless and impracticable. They can have no more effect in controlling the construction

of this patent, than can the cast-tin base, or any other unsuccessful or abandoned experiment.

III.

The State of the Art is fully shown in the following manufactures :

(a.) The gold or silver plate with teeth riveted to it, formed into shape by hammering between a die and counter die.

(b.) The platinum, or continuous gum set constructed like the gold or silver plate, but having porcelain paste gums, baked successively in layers around the roots of the teeth.

(c.) The Wildman gold or silver plate with gums of pure tin cast in a plaster mould around the roots of the teeth and upon the adjoining surface of the plate, thus securing them as by soldering.

THE GOLD OR SILVER PLATE.

These sets of teeth have already been sufficiently described. (See Exhibits Bacon No. 3, No. 4 and 5 ; also Bacon pp. 49–50, Q. 6, 7 and 8, and Starr p. 245.)

THE PLATINUM OR CONTINUOUS GUM SET.

These sets of teeth have also been already described. (See Defendant's Exhibits, Nos. 28 and 29 ; Allen, pp. 233, 234.)

These sets of teeth are the heaviest known, are exceedingly costly, and can only be made by a few very skilful persons.

(Deft's Ev., Allen, pp. 235, 236 ; Plff's Ev., Renwick, p. 52, Bacon p. 185, Q. 8.)

THE WILDMAN PLATE.

This manufacture has already been described. (See Exhibits "E. W. No. 12," E. W. No. 12 A" and "E. W. No. 13"). Dr. Wildman describes his mode of making these sets of teeth with great minuteness (p. 345–347). His die is of zinc cast in a sand mould, and the counter die is of lead, fitting the face of the zinc die, and the gold or silver plate is stamped up between them (p. 345).

This manufacture ls altogether the nearest approach to what is described in the patent, from the fact that at that stage of the manufacture that immediately precedes the casting of the tin, there is a plaster mould in two halves precisely like the mould prepared to be packed with plastic rubber. The stamped or hammered up silver or gold plate, however, fills that portion of the cavity of the mould which Cummings fills with plastic rubber to form the plate proper, thus leaving only a cavity corresponding to the gums or alveolar ridge, which are to be cast in tin and perform the office of a solder to attach the teeth to the plate.

DEFECTS OF METAL PLATES.

All these metal plates had the following defects :

1. They were heavy. (Deft.'s Smith Record, p. 562, Exhibit 52.)

2. It was impossible to accurately fit them to the mouth. (Complts' Rec. Renwick, p. 52, Rushmore, p. 145, int. 6. Deft.'s Smith Record, Ex. 52, p. 562; Ex. 64, p. 428.)

3. A permanently close contact could not be maintained between the gold or silver and the teeth or porcelain gums, in order to prevent the plate from becoming offensive by the lodgment and decomposition of food, and of the fluids and gases of the mouth. (Complits' Rec., Rushmore, p. 145, Int. 12 ; H. B. Renwick, p. 52 ; Deft.'s Smith Record, Ex.65. p. 434 ; Ex. 22, p. 505.)

4. They were liable to bend in case of accidental falling or other violence, thus destroying the accuracy of fit to the mouth and ruining the set. (Complnts.' Rec., Rushmore, p. 146, Int. 16; Deft.'s Smith Rec., Ex. 64, p. 428.) The "continuous gum" sets, owing to the great weight of the platinum, were especially liable to break by dropping (Deft.'s Ev., p. 532).

5. The non-elastic, hard and unyielding character of the plate naturally hurt the mouth and impeded mastication and perfect articulation. (Complts.' Rec. pp. 162, 164, 90, 98; Deft.'s Smith Rec., Ex. 52, p. 562; Ex. 13, pp. 475, 476.)

6. Where partial sets were to be partially supported against the natural teeth, the lack of elasticity compelled the employment of metal clasps, which destroyed the enamel of the natural teeth. (Complts.' Rec., Rushmore, p. 146, int. 21; Deft.'s Smith Rec., p. 566, Ex. 53. Mis-translation corrected by H. B. Renwick at p. 81, Complts.' Rec. See p. 179, Complts.' Rec.)

7. Gold and platinum alone could resist the chemical action of the fluids of the mouth, and the great expense of these metals, and of the skill required in working them, prevented many from availing themselves of the advantages of artificial teeth.* (Deft's Smith Rec., Ex. 38, p. 517; Ex. 39, p. 521; Royce, p. 314, cross-int. 74; Wildman, p. 352, cross-ints. 28, 29, 30; Parmly, pp. 320 and 321; Complts.' Rec., pp. 52, 164, 90, 98; Deft.'s Rec., Allen, p. 235–6.)

8. Metal plates were apt to produce galvanic action, thus changing the character of the secretions of the mouth and affecting the digestion of the patient. (Deft.'s Smith Rec., Ex. 46, p. 554; Ex. 53, p. 566.)

9. The great amount of labor and skill required to success-

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*The cost of constructing a full upper and lower set of teeth by the old method on a gold base is from $120 to $150 (Complt's Rec., pp. 185, 198), and the expense of material is about $37.80 (Deft's Rec., p. 321), making the cost, exclusive of material, $82.20 to $120.20. The cost of full upper and lower continuous gum sets is $250, and the value of the material is comparatively an insignificant item, although platinum is a very costly metal (Deft's Rec. Allen p. 235, Cross Q. 31 to 34). The labor and skill expended are alone worth nearly that sum. Sets of teeth on rubber or celluloid, of good workmanship, are commonly sold for from $15 to $20 for a full set, consisting of an upper and lower. (Compl. Rec., p. 185.)

fully construct a properly fitting metal plate was a most serious matter, not only in respect to cost, but also in respect to the perfection of the result produced, and the ease and comfort of the patient. (Deft.'s Smith Rec., Parmly, p. 320, ints. 26 to 37; Deft.'s Rec., Allen p. 235-6; Complts.' Rec., p. 52.)

A number of attempts have been unsuccessfully made to remedy these defects.

1. Sea-horse and hippopotamus ivory had been carved into the shape of a dental plate, and as nearly as possible to fit the mouth; the teeth were then inserted into the plate. It is obvious that accuracy of fit, either of the teeth to the plate or of the plate to the mouth, was impossible, and moreover the ivory was speedily attacked by the fluids of the mouth and became offensive. (Deft.'s Smith Rec., Ex. 52, p. 562; Ex. 64, p. 428.)

2. Truman had proposed, as we have seen, the use of a skeleton of gold to support the teeth, surrounded by a cushion of gutta percha or wax thickly gilded.

3. Delabarre had suggested the impracticable plan of making the plate or base of gutta percha.

4. Hill had vainly sought to remedy the evils by making the base of his secret gutta percha compound.

Such was the state of the art at the time of the introduction of the vulcanite dental plate.

The great problem at that time presented in the dental art was, to "invent a dental plate which would be easily prepared, cheap, and useful," and which would be free from the defects incident to plates of gold, silver, and platinum, which were then the only plates in successful permanent use. (Deft.'s Smith Record, Hill, p. 367, Cross-Ints. 2 to 6. Starr, p. 245, Plff's Ev., Renwick, p. 52.)

IV.

Vulcanite and its properties including its water-proof character, its capacity of being formed accurately to the shape of a mould, its lightness and its elasticity and hardness at temperatures far above that of the human mouth, were well known before Cummings' inven-

tion. So was the process of moulding the vulcanizable compound in moulds and converting it into vulcanite by heating it and allowing it to cool in the moulds. It was also well known that the compound when packed, must be made plastic by heat, and that vulcanite remained soft while hot, and hardened only on cooling. It was therefore not necessary for Cummings' to describe accurately the method of forming vulcanite in moulds. His reference in his specification to the vulcanite art, imports into it all that was known in that art.

The following facts are established in this case.

1. That the vulcanizable compound is at ordinary temperatures, a tenacious substance (see Compl. Exh. Bacon No. 2, p. 49), resembling pretty closely crude caoutchouc in its degree of hardness. (See Exh. Roby Caoutchouc, p. 175).

2. That in order to render it soft enough to be pressed into the mould, it must be heated (Deft's Ev. Hyatt, p. 223, Q. 17, Colburn, p. 228, Q. 8, Deft's Smith Rec., Parmly, p. 318, Q. 4, pp. 494, 549, 550, 570; Plff's Ev. Warner, p. 46, Bacon, p. 49.)

3. That it softens under the application of heat, until, at the vulcanizing temperature, which is about 300° Fahr., it is about the consistency of tar (Plff's Ev. p. 54).

4. That the heat being continued, it remains soft and plastic as long as it is hot (Plff's Ev. pp. 46, 47, Q. 21, p. 49, Q. 5).

5. That it hardens only on cooling (Plff's Ev. p. 46, 47, X-Q. 21, p. 49, Q. 5).

6. That the mould or die which is used to press the compound into shape, when hot, must be kept in contact with it, until it has cooled and hardened, in order to make it retain the intended form perfectly (Plff's Ev. p. 46).

7. That steam heat has been ordinarily used to produce the vulcanizing temperature since 1852 (Plff's Ev. p. 177, X-Q. 20.)

There is no dispute or contradiction in the evidence upon these points (See Deft's Ev., Hyatt, p. 223; Colburn, p. 228, Deft. Smith, Rec. pp. 494, 497, 549, 550, 551, 570..)

V.

The Cummings patent describes:

(*a.*) A *new process* whereby the Wildman plaster mould, with the teeth in position, is packed with plastic rubber compound, occupying the whole interior of the plaster mould as well the part of the cavity bounded by the plaster contour of the plate proper as the part of the cavity corresponding to the gums or alveolor ridge, so that on the hardening of the substance forming the plate and gums or base in the way well known to those skilled in the art of forming vulcanite in moulds, the "teeth. plate and gums will all be connected, forming, as it were, one piece," thus dispensing with the formation of a die and counter die, and a silver or gold plate swaged as near as possible into shape between them.

(*b.*) A *new product*, strikingly different from the metal plates in prior use, consisting of a set of artificial teeth, combining the properties of lightness, elasticity, perfection of fit by moulding and cleanliness, fully described by this Court in its decision of the Smith Case, 3 Otto, at pages 494 and 497.

THE PROCESS.

Cummings was the first person to invent combining *any substance* when hot and plastic, with artificial teeth, by mould-

ing it about them, while held by plaster in their proper position, so that the whole would be in the required shape and relative position, in one solid piece, when the substance should become hard.

The process so far as it was new with Cummings is purely a mechanical process. This Court held, as we have already shown, that the abandoned experiment, known as the Hawes cast tin process, "it must be admitted, *closely resembled the process* "*described in the reissued patent to the complainants.* He cast "in moulds sets of teeth on a tin base, *in a manner very like* "*that in which the vulcanite plate is formed by the Cummings* "*process.*" (3 Otto, p. 498).

The process of vulcanization and the art of forming articles of vulcanite of any desired shape by means of moulds, are admitted to be old on the face of the Cummings patent. As was remarked in the decision of the Preterre case (15 Blatchf., p.280), under the reasoning of this Court, if Hawes had filled his mould with celluloid instead of tin, he would plainly have defeated Cummings' patent, notwithstanding the fact that the celluloid was softened by heat, and merely hardened on cooling. So if Hawes had filled his mould with any other water-proof elastic substance capable of being made plastic by heat.

The art of moulding vulcanite for miscellaneous purposes being well known, the specification is to be construed precisely as if, instead of the words which Cummings uses, to describe the packing of the mould, he had said: the base is to be moulded in the manner ordinarily practiced by those skilled in moulding vulcanite, care being taken to exert such pressure as to cause the material rendered plastic by heat to be forced into actual contact with the teeth and pins, and to conform perfectly to the shape of the mould, so that on the cooling and hardening of the material the base shall perfectly fit the mouth and embrace the teeth and pins, and all the parts shall be connected, forming, as it were, one piece.

Of course, if any equivalent elastic material were to be used, it must be moulded in the manner known to those skilled in the art of moulding such material, care being taken to embrace the teeth and pins, and form the plate to fit the mouth in like manner.

(Goodyear D. V. Co. *vs*, Gardner, 4 Fisher, 224.)

The instructions in this record, given by the American Hard

Rubber Co., composed of persons skilled in the art of moulding vulcanite, to dentists, who were ignorant of that art, during the period that Cummings' application was pending in the Patent Office, serve to illustrate this subject. (Deft. Smith, Rec. pp. 549–551, 570.)

THE PRODUCT.

This Court says (3 Otto, 494), as we have already shown, that: "A *new product* was the result, differing from all that had preceded it, not merely in degree of usefulness and excellence, but *differing in kind*, having new uses and properties. It was capable of being perfectly fitted to the roof and alveolar processes of the mouth. It was easy for the wearer and favorable for perfect articulation. It was light and elastic, yet sufficiently strong and firm for the purposes of mastication. The teeth, gums and plate constituting one piece only, there were no crevices between the teeth and their supporters into which food could gather and where it could become offensive, and there could be no such crevices so long as the articles lasted. They were unaffected by any chemical action of the fluids of the mouth. Besides all this they were very inexpensive as compared with other arrangements of artificial teeth. To us it seems not too much to say that all these peculiarities are sufficient to warrant the conclusion that the device *was different in kind or species from all other devices.*"

And on page 497, this manufacture is spoken of as "a set of artificial teeth, light and elastic, easily adapted to the *contour* of the mouth, flexible, yet firm and strong, consisting of one piece, with no crevices between the teeth and the plate, impervous to the fluids of the mouth, unaffected by the chemical action to which artificial teeth and plates are subjected when in place, clean and healthy — *peculiarities which distinguish it from everything that had preceded it.* These differences, in our opinion, are too many and too great to be ascribed to mere mechanical skill. They may be justly regarded as the results of inventive effort, and as making the manufacture of which they are attributes, *a novel thing in kind*, and consequently patentable as such."

The Circuit Court of the Sixth Circuit, Judges Emmons, Longyear and Withey sitting together, had previously used similar language in commenting on this invention, in the suit

of Goodyear D. V. Co. *vs.* Willis, in the record of which the evidence in the Smith case was included (7 Off. Gaz., p. 45). They say:

"It is also insisted that the complainants' manufacture is anticipated by several pre-existing dental plates. It is not deemed necessary to contrast any of these devices with that before us. It has been frequently done by other tribunals, before which they have also been proved, and in every instance judicially pronounced to be wholly unlike that described in complainants' claim. *There is not sufficient similarity to demand at our hands a comparison.*"

VI.

Celluloid is a water-proof substance that is precisely like vulcanite in respect to the qualities that characterize Cumming's product, viz.: lightness, elasticity and hardness at temperatures far above that of the human mouth, and capacity of being formed in plaster moulds, so as to produce perfection of fit and close adaptation to the teeth.

This proposition is not disputed. It appears upon an inspection of the exhibits made of celluloid and an examination of their physical properties, and is fully proved by the evidence.

(See Exhibits, Hyatt Nos. 1, 3 and 4, and Plff's Rec., pp. 36-38, 40, 46, Q. 7, p.p. 53, 54, 82, 87.)

VII.

The defendant with moulds made by the same method as Cummings's combines celluloid with artificial teeth by

moulding it about them when hot and plastic, so that the whole will be in one piece in the required shape, with the teeth in their proper position, when it becomes hard, and when the products of this and the Cummings process are done, their mechanical structure is identical. They are so near alike that they can hardly be distinguished the one from the other, the resemblance being so exact as to deceive the very inventor of the celluloid base for artificial teeth.

The defendant's method of making celluloid sets of teeth has already been fully explained. We again refer the Court to the "Circular of Instructions" issued by the Celluloid Manufacturing Co. (p. 41).

The identity of the vulcanite and celluloid sets of teeth considered as products is evident on an inspection of the specimens in evidence. (See Complainant's Exhibits Vulcanite Partial Set and Hyatt No. 5, and compare them with complainant's Exhibits Hyatt No. 3, and Hyatt No. 4. See also H. B. Renwick, p. 53).

We quote from the evidence of I. S. Hyatt, one of the patentees and the manufacturer of the celluloid (pp. 35, 36) and the Vice-President of the Celluloid Manufacturing Company, the real defendants (p. 36). He testifies as follows (pp. 37, 38):

"Q. 15. Look upon the thing now shown you, and state by what name it is commonly known?

A. A celluloid set of artificial teeth—a partial set; that is, a set having some of the teeth omitted.

Complainants offer the set of teeth referred to, and the same is marked Complainants' Exhibit Hyatt No. 3, J. A. S., Exr.

Q. 16. Look upon the thing now shown you, and state by what name it is commonly known?

A. I think that is a set of rubber teeth; it is commonly known as a hard rubber set of artificial teeth.

Complainants offered the last set of teeth referred to, and the same is marked Complainants' Exhibit Hyatt No. 4, J. A. S., Exr.

Q. 17. Look upon the thing now shown you, and state by what name it is commonly known?

A. That is known by the name of a hard rubber set of teeth.

Complainants offer in evidence the last named set of teeth referred to, and the same is marked Complainants' Exhibit Hyatt No. 5, J. A. S., Exr.

Witness states—Exhibit Hyatt No. 4 is made of *celluloid instead of rubber*; it is made from *one of our bases* produced, I should think, three or four years ago, or at all events before we had succeeded in producing a color similar to Hyatt Exhibit No. 1, many of the celluloid bases made formerly being similar in color to some kinds of red rubber. *By examining it as to smell* I discovered my mistake.

Q. 18. Between your answer to question No. 16 and your correction thereof, *did you not rub Exhibit No. 4 violently upon cloth*, and *did you not scratch and cut it with your penknife and then smell it, before you put the correction upon the record?*

A. As soon as the Exhibit No. 5 was placed in my hands I discovered my mistake at once, from noticing the smell of the rubber, and remembering that I discovered no smell in Exhibit No. 4, I immediately said that I had made a mistake, and was sure of it before any scratching or violent rubbing had been done; the difference in appearance between the two Exhibits was apparent by a comparison.

Objected to as as irresponsive, and the witness is requested to answer the question.

A. Yes, after I had discovered my mistake.

Q. 19. Did you not *first cut a hole in the rubber base and smell the fresh cut?*

A. *I cut the hole in the rubber plate and smelt it, before making the correction.*"

VIII.

The celluloid is, for this purpose, clearly the mechanical equivalent of the vulcanite.

Upon this point Mr. Henry B. Renwick says (p. 53):

"The physical characteristics of the substance which forms the plate, in order to fit it for holding artificial teeth, in substantially the manner described in Cummings' patent, are: first, capability of being formed or moulded around the roots of the teeth and pins while in a soft and plastic condition; and second, strength and elasticity when cold and hard, such as is possessed by whalebone, ivory, vulcanite and solid collodion, so that it shall be sufficiently strong and rigid for the purpose of mastication and at the same time elastic enough to yield slightly to the pressure of the jaw. The process described in the patents referred to in the question, as being practiced with celluloid and teeth, must necessarily result in an article of manufacture containing all the features that constitute, as before stated, the distinguishing characteristics of the vulcanite dental plate. I have examined many vulcanite dental plates, and a considerable number of solid collodion or "celluloid" dental plates, and after looking at and handling them, was unable to decide which were vulcanite and which celluloid; in fact I picked out, in several instances, celluloid as

vulcanite, and vulcanite as celluloid. I then compared those composed of the one material with those composed of the other, and could distinguish no difference in their physical characteristics, except in their odor, and in the slight translucency possessed by solid collodion or celluloid, not deeply colored."

The Circular of Instructions issued by the Celluloid Manufacturing Company, says (p. 40):

"For regulating plates, and indeed *in every place where rubber as a vulcanite can be used*, celluloid may with advantage be *substituted for it.*

IX.

For the purposes of this case it is immaterial whether celluloid was known or unknown at the date of Cumming's original patent. The doctrine of Gill *vs.* Wells (22 Wall., 1), that a substitute for an ingredient in a combination must be a known equivalent at the date of the patent to constitute substantial identity between the combinations has no application to the case of a bare substitution of one material for another without any resulting difference of function or effect.

Goodyear Dental Vulcanite Co. vs. *Gardner* 4 Fisher, 224, is an authority that sustains this proposition. It was directly involved in the three decisions of the case in favor of complainant upon the hearing of the motion for injunction, upon the final hearing, and upon the hearing upon appeal in this Court. Whatever criticism may be made upon this case is not applicable to the hearing of the motion for injunction defended by Mr. Thurston and Mr. Law (See 7 Off. Gaz., p. 43.) The acts criticised occurred long after the decision of the motion.

Such a substitution can be made by any person possessing ordinary mechanical skill, whether the substituted material is of recent origin, or is old, and the fact that the material is of recent origin, can never entitle the person making such substi-

tution to thereby make with impunity substantially the article secured by the patent.

It was upon this principle that Mr. Justice Clifford upon both hearings in the Circuit Court, held the iodite dental plate to be an infringement of this patent, although iodite was not discovered until 1868, and was confessedly a new substance; it not being known until 1868 that the material iodine could be used as a substitute for sulphur with rubber, for the purpose of making a substance resembling vulcanite. The iodite process was manifestly not an infringement of the Goodyear patent, nor was the product; but combining iodite with mineral teeth, substantially as described in the Cummings patent, was a clear infringement, although the material was new.

This we submit is alone sufficient to show the irrelevancy of the first proposition above stated (p. 12 Brief), upon which the Court below based its decision, viz: That celluloid is a new material discovered and patented since the date of Cummings' invention.

X.

"Celluloid" is a trade-mark name for solid collodion, which was a known elastic water-proof substance, capable of being made plastic and moulded in plaster moulds by the aid of heat, and well known long prior to the date of Cummings' original patent, as a substitute for vulcanite, for the purposes of dentistry, button manufacture, and almost every conceivable general purpose in the arts.

The substance used by the defendant as a base for artificial teeth is a kind of solid collodion known by the trade-mark name of "celluloid" (pp. 53, 103, 105, 107, 247). Collodion was well known prior to 1854. It is a solution of pyroxylene, sometimes called xyloidine and commonly known as gun-cotton, in a solvent. Sulphuric ether, and alcohol, mixed, and camphor dissolved in alcohol are among its well known solvents. When the solvent is evaporated, solid collodion is the result.

It possesses the elasticity of whalebone, ivory and vulcanite (p. 53). James A. Cutting's English patent, dated July 26, 1854, describes the addition of gum camphor to the solution, for use on photograph plates, stating that the camphor increases the fineness of the solid colodion, spread upon the plate (p. 206).

Alexander Parkes' English patent, dated October 22, 1855, describes the use of solid collodion alone or combined with gums or resins, for manufacturing purposes generally where a water-proof substance is required. He speaks of this substance as a hard, strong water-proof material, suitable for button manufacture, book-binding, etc. (pp. 210, 211.)

At this time Dr. Cummings had applied for his patent, and soon after his process came to the knowledge of the public. The earliest date of such knowledge proved in this record is about 1856 (p. 244).

John Macintosh's English patent, dated December 8, 1859, shows that it did not long remain unrecognized that the close resemblance between the two elastic water-proof substances, solid collodion and vulcanite, made them obvious substitutes for each other in the construction of a base for artificial teeth. Macintosh's description is as follows (Deft's Ev., p. 489):

"This invention has for its object improvements in setting artificial teeth, and consists in employing for this purpose the preparation known by the name of collodion, which is a solution of gun-cotton or fibre in a solvent. The following is the manner in which I prefer to proceed: I obtain, in the usual manner, an impression in wax of the form of the jaw of the person for whom the set of artificial teeth is to be made, and from this I make a mould in plaster, as is well understood. Into this mould I again cast plaster, and so obtain in plaster a copy of the original wax impression of the jaw. On to this form I build up in wax or other material a thickness equal to that of the collodion setting which it is desired to produce, and the teeth to be set are imbedded in the wax in the same manner as they are to be in the collodion setting; when this is produced on the wax model, and while it is still on the form, it is oiled all over and a plaster cast is taken of it; this, when set, is removed from the form, and the teeth will be found firmly imbedded in it. The whole of the wax is then carefully removed. Thus two plaster forms are obtained, which, when put together, form a mould, and inclose between them a space corresponding in form with the collodion setting to be produced. These forms are placed in a metal box, such as is used *in the vulcanite process, which is well understood by dentists,* and they are secured, the one in the top and the other in the bottom of the box by running them in with plaster. The collodion to be employed may be prepared in the ordinary manner. And I prefer in order to increase its toughness to mix with it a small quantity of short cotton fibre, and I evaporate the solvent until the collodion is brought to a plastic and putty like state. If it be desired to obtain a hard setting, I add to the collodion, and thoroughly incorporate with it powdered gum copal, in quantity varying according to the hardness desired. If great hardness is required I employ as

much as twenty per cent. *The collodion, whilst still warm, I carefully press into the mould around the teeth, as in filling a mould with the compound of india rubber and sulphur in making teeth of vulcanite, as is well understood.* I then place the two parts of the mould together, and force them together by means of the screw with which the box containing them is fitted; thus the collodion between the two parts of the mold is forced into every crevice of it; and in order *that the collodion may remain thoroughly plastic the mould is kept heated* to about 200 degrees Fahrenheit. When the two parts of the mould are pressed close together, the mould is allowed to cool, and when cold the teeth with the setting, which is then complete, are removed."

Barnwell & Rollason's English Patent, dated September 15, 1860, describes the use of solid collodion for the manufacture of articles "hitherto made of glass, china, metal, wood, *india rubber* and such like materials," and as a material from which buttons can be stamped out as from horn, or can be moulded while the substance is in a plastic state, and it also states that by shaping it as "pressed glass is made" it is very useful for taking fine casts such as those required for purposes of dentistry (p. 213).

Letters Patent of the United States, dated July 12, 1870, were granted John W. Hyatt, Jr., and Isaiah S. Hyatt for an invention entitled by them "a new and improved process of dissolving pyroxylene and of making solid collodion." The invention consists in mixing powdered gum camphor with finely divided pyroxylene, and then subjecting the mixture to pressure, and a heat of 150° to 300° Fahrenheit. The camphor when liquefied or vaporized by the heat becomes an active solvent of pyroxylene. The specification says (p. 104):

"By introducing the solvent in the manner here described, and using heat to make the solvent active and pressure to force it into intimate contact with every particle of the pyroxyline, we are able to use a less proportion of this or any solvent which depends upon heat for its activity than has ever been known heretofore. After keeping the mixture under heat and pressure long enough to complete the solvent action throughout the mass, it is cooled while still under pressure, and then taken out of the mould. The product is a solid about the consistency of sole leather, but which subsequently becomes as hard as horn or bone by the evaporation of the camphor. Before the camphor is evaporated, the material is easily softened by heat, and may be moulded into any desirable form, which neither changes nor appreciably shrinks in hardening."

"We are aware that camphor made into a solution with alcohol or other solvents of camphor has been used in a liquid state as a solvent of xyloidine. Such use of camphor as a solvent of pyroxyline we disclaim."

This is the original "celluloid" patent. The utmost that can be claimed for it is that it describes *an improved solid collodion.*

Letters Patent of the United States dated March 28, 1871, granted to I. S. Hyatt, J. W. Hyatt, Jr. and Jesse A. Perkins, show that they were not slow to recognize the fact that was apparent to Macintosh in 1859, that the two elastic water-proof substances, solid collodion and vulcanite, are obvious substitutes for each other in the construction of a dental plate. This patent describes a process and product substantially identical with that described by Macintosh. The invention is entitled "Improvement in Dental Plates from Pyroxyline." The specification states as follows (p. 247):

"In the manufacture of dental plates or bases for artificial teeth, *vulcanite or hard rubber*, which has been extensively employed for the purpose, has been found objectionable on account of its dark color, offensive taste and smell at times, liability to break when chilled, and difficulty of repairing the plates when broken; the large amount of mercury contained in the coloring material (vermilion) employed, which renders it particularly obnoxious to some persons; the length of time required to manufacture the plates and the qualities, which render it unpleasant for dentists to manipulate. * * * * * * * * *

"Our invention consists of a dental plate or *base* for artificial teeth, composed of a kind of *solid collodion*, such as is described in Letters Patent of the United States granted to I. S. Hyatt and J. W. Hyatt, Jr., July 12, 1870, numbered 91,841, in which the transformation of the pyroxyline is effected by the use of camphor as a solvent, whereby the thoroughly dried product or collodion is rendered plastic by heat, so as to be readily moulded without subsequent shrinkage, as hereafter described and without the use of fixed oils or fusible non-solvent gums, which are required to be combined with the material when ether, alcohol, or other ordinary solvents are used, which fixed oils and gums forming a part of the permanent compound, impair its qualities of strength, durability, purity, fineness of texture, &c., so essential in a dental plate.

"In the manufacture of collodion for our dental plates, we prefer to use at least fifty parts, by weight of gum-camphor to 100 parts of soluble cotton. A greater proportion of camphor may be used, whereby the product is rendered more plastic than when a less quantity is employed. The collodion thus produced is made into plates of suitable thickness, and are preferably formed into shapes approximating those of finished dental plates by pressing in heated molds. The plates thus formed are now thoroughly dried by placing them in a drying room, heated to a temperature which should not exceed 180° Fahrenheit, 150° to 180° being the temperature we have found best adapted for expelling the camphor solvent. A temperature much higher than 200° will expand the material and render it porous and brittle.

"The plates when properly dried, although freed from liability of shrinkage, still retain the quality which enables them to become plastic under a proper degree of heat, and readily molded into any desired shape without subsequently shrinking to any injurious extent after being so remolded.

"In making a set of teeth of our improved base, *the case is prepared and teeth set in plaster by the same process and in the same manner as is done in making a set of hard rubber*, except that the trial-plate should be made thinner. Care should be taken to use the best quality of plaster, and to thoroughly dry the casts before proceeding with the final process. Around the outside of the teeth, next to the flask, is cut a

channel, connected by short channels or gates with the inside to receive the excess of material. When the flasks are thus prepared, a plate of our base is placed in the lower flask and the upper flask upon it, when the two flasks are put into a screw-clamp ready to be forced together. The flasks and clamp are then set into a small tank of oil (good sweet-oil works finely and emits no odor), and a gas jet or alcohol lamp placed under the oil tank is lighted, and the oil heated to 300° (never above 310° Fahrenheit), which is determined by a thermometer attached to the vessel. As the oil heats, the plate becomes softened and plastic, when the clamp is gradually screwed down to place, scarcely any force being required until the last, when the proper degree of heat being reached, the flasks are forced firmly and completely together. The clamp and flasks are then lifted out of the oil, and if the flasks are seen to be entirely together on all sides, the work of moulding is done. The flask and contents are then immersed in cold water and thoroughly cooled, when, upon opening the flasks, the case will be seen to be molded in the most perfect manner, the teeth firmly attached, and the shape of the plaster molds perfectly taken to the minutest particular. The case is then freed from plaster with brush and water, and finished and polished *as would be done with rubber*. Chalk is used as a last finish with cotton wheel and water.

This is the "celluloid" dental plate patent. (See the celluloid dental plate blank, Exhibit Hyatt No. 1; also p. 36 and answer p. 21.)

Letters Patent of the United States, granted to said John W. Hyatt, Jr., and Isaiah T. Hyatt, dated December 5, 1871, states its subject matter as follows (p. 105):

"Our invention relates to certain improvements in apparatus employed in the manufacture of sets of artificial teeth from collodion plates, produced according to the improved process described in Letters Patent No. 113,055, and dated March 28, 1871, to which reference is here made for a description thereof.

"In making a set of artificial teeth according to this process, the prepared plates are placed within the flask and heated to the temperature of about 300° Fahrenheit, which is most conveniently effected by placing the flask and clamp in a vessel containing oil and bring the same to the required temperature, which softens and renders plastic the plate so as to enable it to be properly mou'ded and attached to the teeth."

Letters Patent of the United States granted to said John W. Hyatt, Jr., and Isaiah S. Hyatt, dated June 23, 1874, No. 152,232, states its subject matter as follows (p. 107):

Our invention relates to the treatment of such compounds of converted vegetable fibres as become plastic under heat, so as to permit the same to be molded when in that state, and especially "*celluloid*," which is *a term used as a trade mark*, and applied to a compound produced and manufactured under Letters Patent Nos. 105,338, 113,055, 133,229, and dated respectively July 12, 1870, March 28, 1871, and November 19, 1872,

The inflammable nature of this material, and the ordinary compounds of pyroxline, when raised to too high a degree of heat, in connection with other peculiar

qualities, distinguish these compounds from others, so as to require in the molding of articles therefrom, a more or less special manipulation thereof.

The molding of these compounds, or such of them as become plastic under heat, has heretofore been accomplished by placing the material in molds (usually metallic), and then heating the molds in an oven, or on steam tables, whereby the material is subjected to a dry heat.

The first part of our invention consists in subjecting the material, in porous or other suitable molds, to the direct action of steam, which not only heats and softens the mass with great facility, but, by excluding the heated air therefrom, and immersing the material in steam, diminishes to a great degree the liability of combustion taking place, while it absorbs more or less of the volatile solvents remaining in the material. * * * * * * *

The temperature required will vary somewhat according to the quality and condition of material. The more thoroughly seasoned or dried the material the greater the temperature required.

For molding celluloid this temperature ranges from 212° to 300° Fahrenheit, and, consequently, requires a pressure of from that of the atmosphere to sixty four pounds above.

The material to be molded is placed within the molds until softened, when the molds are gradually forced together in the ordinary manner. (p. 108)

Dental plates are usually moulded by the use of steam heat at from 270° to 300° F. in the manner described in this patent (pp. 37, 44, 108). The answer admits that defendant made his dental plates with this apparatus (p. 21).

It will thus be seen that celluloid is solid collodion and that solid collodion is a substance capable of being rendered highly plastic with the aid of a high degree of heat, that it is, like vulcanite, a water-proof substance, elastic at ordinary temperatures and about as hard as horn, bone or ivory, and that it is a substitute for vulcanite for general purposes in the arts, and was known as such long prior to the date of Cummings' original patent.

The suggestion in the opinion of the Court below in respect to substitutes known at *the date of the plaintiff's invention* is founded upon a misapprehension of the law, resulting from an error contained in the report of the case of Gill *vs.* Wells, in Vol. 6, Off. Gaz., 885, fourth paragraph, second column, which is in these words, "or even if it is old, but was not known at the date of plaintiff's *invention* as a proper substitute for the omitted ingredient, he does not infringe. The word "*invention*" in the quotation was an error, and should have been *patent.* The attention of the Court was called to this mistake, and the error was corrected, and in the case as reported in 22 Wallace, on page 28, line 27, the word "*patent*" is substituted for the word *invention.* A patentee is at least entitled to pro-

tection against the use of all equivalents for the thing described, known as such at the time when his protection commenced. If the rule were otherwise the grant of a patent might be a mere mockery, where substitutes had been introduced during the period in which the grant of the patent had been delayed by the Patent Office.

The patent is a grant, and as such must speak from its date.

> Goodyear Dental Vulcanite Co. *vs.* Preterre, 15 Blatchf., 280.

The case of Imhaueser *vs.* Buerk, 101 U. S., 640. would seem to set this matter at rest. It holds that "Letters Patent for a combination of old ingredients are infringed by substituting for one of its elements a mechanical equivalent that was well known to be such *when they were granted.*"

Fuller v. *Yentzer*, 4 Otto, 297 is to the same effect.

These facts and considerations we submit are also sufficient to show the irrelevancy of the first proposition, above stated (p. 12 Brief), upon which the Court below based its decision, viz: That celluloid is a new material discovered and patented since the date of Cummings' invention.

XI.

To substitute "celluloid" for vulcanite in this combination, required the exercise of the merest mechanical judgment. It was the bare substitution of one material for another, without any new result. "Celluloid itself may be patentable and patented, but the use of it in this manner in the formation of dental plates could not be in the light of Cummings' invention; and whether the invention of this use of them would be patentable, in view of the other patent, is one accurate test of whether it is an infringement of that patent."

The first branch of this proposition seems to be admitted by the defendant, for he says in his answer, p. 21 that the Hyatt & Perkins Dental Plate Patent, No. 113,055, is "for an improvement in forming said material made by the aforesaid process, into a *blank* or plate, for use as a dental base;" and Hyatt says (p. 36), that Exhibit Hyatt No. 1 is a "celluloid dental plate blank; the word blank is not always used; it is commonly called a celluloid dental plate," and that "the words 'patented, July 12, 1870, March 28, 1871,'" refer to said patents, No. 105,338, and No. 113,055.

This point is so well covered by the decision in the Preterre case above quoted (15 Blatchf., 280, 281, Brief, p. 20), that we need not elaborate it.

XII.

The patentee having invented and claimed a new article of manufacture—"a novel product,"—is entitled to protection against the unauthorized use of a substantially similar article independent of the question whether the process, by which it is produced, is the same or different from the process described in the patent.

The claim "The plate of hard rubber or vulcanite or its equivalent for holding artificial teeth or teeth and gums substantially as described is a claim for a new article of manufacture; for the thing itself, when produced and exhibited, characterized by certain novel peculiarities not found in anything pre-existing. No words could be chosen more clearly expressing a claim for a new article of manufacture. In the words of the Supreme Court (p. 494), "*a new product* was the result, dif-"fering from all that had preceded it, not merely in degree of "usefulness and excellence, but differing in kind, having new "uses and properties. * * * * * * * "To us it seems not too much to say that all these peculiarities "are sufficient to warrant the conclusion that the device was "*different in kind or species* from all other devices."

This product was not only new, so that its novel features would entitle it to a very high place among useful inventions, and would entitle it to the protection of the Courts, but further in creating it Dr. Cummings invented not only a new product, but the process by which it was produced ; and this accident, while it in no manner alters Dr. Cummings' legal right to be protected against the unauthorized use of the product which he invented, elevates the invention to a higher plane, and excites our admiration the more for him who made the invention. Unless it be an imperative necessity to restrict the protection of the inventor by the words used in his specification, we suppose it to be the policy of the law to protect him to the fullest extent, and not to deprive him of the use, for the limited term of seventeen years, of any portion of what he has given to the world for eternity.

The Courts have uniformly sustained this patent, for two reasons, either of which is amply sufficient: *First*, because the thing itself is characterized by a number of qualities which are peculiar to it, and which are new ; and *Second*, because it is the product of a process which itself is new. If the patent stood upon the first reason alone, it would be entirely sufficient to cover any similar product by whatever means produced ; and the second reason fortifies the first, and elevates this invention into the highest class of manufactures ; namely, those in which the thing produced itself is new, and the process by which it is produced is also new.

The set of teeth of the defendant is proved to be identical with the thing patented as an article of manufacture, because it possesses all the novel qualities which characterize the thing patented. On this issue there is no contradictory testimony, the defendants having failed to produce a single witness who has attempted to discriminate the thing manufactured by them from the thing patented. And it may not be too much to say that there never has been another case in which, infringement being denied, the patentee of the infringing manufacture himself, who is also the managing manufacturer for the real defendant, was unable to distinguish the thing patented and made by himself, from the thing patented by the prior patentee, and under oath, said that the thing he made was really the thing originally patented.

We submit, therefore, that the evidence conclusively shows exactly the contrary of that branch of the fourth proposition

above stated (p. 12 Brief) relating to the product, upon which the Court below based its decision, viz: That *the manufacture itself*, the *set or plate of teeth* differs as much as a product from the product described and claimed in the Cummings patent as that product differed from those previous manufactures which existed before the Cummings invention and were unsuccessfully relied upon as anticipating it.

The Wildman silver or gold plate with cast tin gums is certainly the nearest preexisting product, and we can best express its relation to the vulcanite dental plate by saying that "there is not sufficient similarity to demand at our hands a comparison" (G. D. V. Co. *vs.* Willis, 7 Off. Gaz. p 45).

In this state of the evidence, it would seem that there is no conclusion possible to be drawn by the Court, except that the two things are, in law, identical; and this *irrespective of the question whether the process is the same or not.*

XIII.

Not only is the product the same, but the process is substantially the same; it is the process common alike to the manufacture of sets of teeth on the vulcanite base, the celluloid base, and the cast tin base described in the opinion of this Court (3 Otto, p. 498), with this exception, however, that in casting tin no pressure could be employed to insure a perfect fit and close contact of the base with the teeth, while the packing by pressure of the moulds holding the teeth in position is an essential feature of both the vulcanite and celluloid processes.

As we have already pointed out, this Court said that the cast tin process of Hawes "closely resembled the process described in the reissued patent to the complainants," and this reference was only disposed of (1.) by holding it to be an abandoned experiment; (2.) by holding that the product—the set of teeth itself—was substantially different. If this patent was to be lim-

ited to a process including vulcanization of rubber compound in contact with teeth, without unvulcanized equivalents, this Court would never have weighed the voluminous evidence proving the cast tin case to have been an abandoned experiment, and proving the qualities of the product to be substantially different from the vulcanite set of teeth. Tin certainly is not a vulcanizable gum, and if this patent was to be thus construed it would have been an obvious answer to the reference to say that this patent is for a product produced by a process involving vulcanization of rubber in contact with teeth, and tin is not vulcanizable.

Dr. Rushmore says (p. 146 Q. 12): "The vulcanite or rubber being used in a plastic condition, its adaptability to the teeth *from the pressure used* is nearly perfect."

The decision in the Preterre case (15 Blatchf., 277–281) already quoted (Brief p. 18–20), so well demonstrates this proposition that we need not dwell further upon it.

We submit therefore that the evidence conclusively shows that there is no foundation for the second and third propositions and that branch of the fourth proposition relating to the process, stated above, as those upon which the Court below based its decision (p 12 Brief).

The celluloid certainly *is* placed *in* the mould in a soft plastic condition and is *pressed in* in a "*convenient way*" while soft and plastic, and not "in a hard rigid condition like horn or bone or ivory," otherwise it would crush the plaster moulds to powder.

The celluloid and vulcanite processes certainly *do* resemble each other far more closely than the vulcanite process resembles the Wildman process for making the silver or gold plate with cast tin gums, which is the nearest approach to Cumings' process that pre-existed.

This disposes of all the propositions upon which the decision below was founded.

XIV.

The claim of the patent, "The plate of hard rubber or vulcanite, or *its equivalent*, for holding artificial teeth, or

teeth and gums, substantially as described," is for these reasons infringed by the plate of celluloid for holding artificial teeth, or teeth and gums, as constructed by the defendant.

Unless there is something in this patent that restricts the inventor to *vulcanite*, and compels the Court to deny him protection against equivalents, this proposition would seem to be established.

The question whether the patent is restricted to vulcanite is older than the celluloid controversy.

In the Gardner case (4 Fish., 224), the defendant was sued under this patent for making sets of artificial teeth out of a new substance invented and patented in 1868, called "iodite," and the defenses urged were substantially the same as those urged in this case, viz.: that there was no infringement, because the defendant did not use the substance described in the patent, but a different substance; that the patent was for the mere substitution of the material—vulcanite—for the metallic substances previously used in the construction of sets of teeth; that the process involved a chemical preparation of soft rubber and sulphur subjected to heat in the manner described in the Goodyear patent, and that no one could be regarded as an infringer unless he used every one of the ingredients of the process. The question in that case was a pure question of law, upon an undisputed state of facts.

Mr. Justice Clifford held upon a stoutly contested motion for injunction defended by Mr. Thurston and Mr. Law, (see 7 Off. Gaz., 43), and afterwards upon final hearing, that the iodite dental plate is an infringement of the Cummings patent, and the Supreme Court affirmed that holding. Mr. Justice Clifford stated in the opinion of the Circuit Court that "in the view "of the Court, it is not necessary to determine whether the "material used by the respondent is the same or different "from that described in the hard rubber patent, to which "reference is made in the specification of the complainant's "patent". (4 Fisher, 230.)

And he concluded his opinion as follows: (p. 231.)

"Two theories appear to be maintained by the respondent, "and they are not entirely consistent:

"1. That the invention used by the complainants is merely

"a discovery that hard rubber, as manufactured under the hard "rubber patent, may be applied as a substitute for metallic "substances in forming plates for artificial teeth and for se- "curing the teeth in position."

"2. That the invention is merely a discovery of a chemical "process for preparing a described substance for use in form- "ing plates to be used for the before mentioned purpose, and "that no one can be regarded as an infringer unless he uses "every one of the ingredients of that process."

"But neither of the theories is correct. Sufficient has al- "ready been remarked to refute the first suggestion, and it is "quite obvious that the second is equally fallacious and un- "supported by anything to be found in the specification."

If the invention consists of a mere substitution of Nelson Goodyear's hard rubber exclusive of eqnivalents, for the metals previously in use, or if the invention depends upon a chemical process, and cannot be practised except by using a compound of so many parts of rubber and so many parts of sulphur, that ends this controversy, and Mr. Justice Clifford and this Court should have decided the *Gardner case* in favor of the defendant, for Gardner did not use the material known as "hard rubber or vulcanite" described in the patent, but an entirely new material, then recently invented and patented. If, on the other hand, the process is mechanical, irrespective of the chemical constitution of the material employed, or if the patent is for a new article of manufacture, then the chemistry of the question is not in the case at all.

In his original application of April 12, 1855, and in his original patent granted June 7, 1864, Dr. Cummings points out the obvious fact that in making his improved set of artificial teeth the base need not necessarily be made of vulcanite, but "in fact of *any elastic substance* which can be *reduced to a soft* "*condition* and then vulcanized or *hardened sufficiently to* "*answer the purpose.*" (pp. 164, 91).

The mere substitution of one material for another in a combination is patentable where the result is the production of an analogous, but substantially different manufacture, and "this is true of all combinations, whether they be of materials or processes. (Smith case, 3 Otto, 497, and cases cited.)

It is not conceivable that there can be a valid patent for such a substitution of material that would not necessarily cover as an

equivalent the use of any other analogous material possessing the qualities for the particular use which distinguish the material mentioned in the patent from the materials in prior use for the same purpose.

See cases cited on pp. 26–29 of this Brief.

We have already shown that the facts proved in this case are the same as those stated to be proved in the opinion of the Court in the Preterre case (15 Blatchf., 274), with the single exception, that we have not here proved the fact established in that case, that solid collodion was a known substitute for vulcanite on May 14, 1852, the date of Cummings' *invention*, and we have also shown that that fact is immaterial. We will therefore close the discussion of this point, by referring this Court to the opinion in the Preterre case, already quoted in this brief (p. 16-20), and by quoting the evidence of Henry B. Renwick on this subject, which is as follows (p. 51):

"I have frequently read and examined the Reissued Letters Patent, No. 1,904 granted to the Dental Vulcanite Company, dated March 21st, 1865, and I thoroughly understand the same, and the invention described therein. The invention, as claimed, may be described as a new article of manufacture, consisting of a plate of hard rubber or vulcanite or its equivalent, for holding artificial teeth, *with teeth or teeth and gums secured thereto in the manner described in the patent*, the whole making what is sometimes called a case, or in ordinary language, a set of artificial teeth. The manner described in the patent of securing the teeth to the plate is by imbedding the teeth and pins in the plate while the substance of which it is composed is in a soft or plastic condition, so that when the material composing the plate becomes hard the teeth are firmly secured by being imbedded, with their pins, in the substance composing the plate, so that there is a tight joint between the plate and the teeth, the whole forming substantially one piece. The material composing the plate must, when hardened, be an elastic material, possessing and retaining in use sufficient strength, and rigidity for the purpose of mastication, and at the same time being elastic enough to yield a little to the motions of the mouth. It may be said here, as further illustrating my idea of what the invention is, that *it does not consist in the mere application of vulcanite, or a substance possessing the same characteristics, for the required purpose in place of metal. For instance, if a plate of vulcanite were formed into proper shape, and the teeth were then riveted to it, as they have been to a metal plate, then the completed article, with the teeth riveted to the vulcanite would not be the new article of manufacture described in the Cummings patent.*

"Laying out of view the attempts to cast whole undersets of pure tin by George E. Hawes and William A. Royce, and the attempts made to use unvulcanized gutta percha, which, as I understand, were unsuccessful and impracticable, the only sets of teeth in practically successful use were made by striking up thin sheets of gold, silver or platinum between a die and counter die, and then soldering the teeth to the plate by means of small platinum pins attached to the teeth. The die and counter die

were formed by taking a wax or plaster impression of the part of the mouth proposed to be fitted by the finished plate. From that impression a plaster cast was taken, which was an exact model of the mouth. From this model a mould in sand was made, into which was cast a hard metal—zinc being generally used for the purpose. This formed the die, which was thus a reproduction of the plaster model. A counter die of lead was then cast, fitting the face of the zinc die; the sheet of metal was then stamped into shape, by repeated blows of a hammer, between the die and counter die. The high temperature which platinum will bear without melting enabled the dentist to apply to sets of teeth, when mounted on a platinum base, a sort of porcelain paste, which was applied to the teeth and metal plate, and afterwards baked into porcelain, the gums being formed of this paste, which was converted into porcelain by the baking. These were known as continuous gum sets of teeth. As I understand, however, owing to the great expense of such sets of teeth and their great weight, but few of them were used. A plate constructed on Cummings' system possesses qualities which clearly distinguish it from all the sets of teeth preceding it. In the first place, it fits better, as the dentist is enabled to form the plate upon the original plaster cast of the mouth, thus dispensing with the difficult and inaccurate process of constructing dies and counter dies, and stamping the plate up between them. The result is necessarily an accuracy of fit not to be attained by the old method. In the second place, there is a much tighter joint (I may say a perfect joint) between the teeth and the plate than is found in the old plates, where the porcelain teeth are riveted and soldered to a metal plate, and thus cleanliness and purity are attained by the use of the Cummings plate, owing to the absence of crevices between the teeth and plate, into which, when they exist, fluids from the mouth are apt to enter and decompose. In the third place, the teeth, when imbedded in an elastic material, possessing and retaining in use sufficient rigidity and strength for the purpose of mastication, and at the same time elastic enough to yield a little to the motion of the mouth, are capable of yielding, when subjected to the pressure of the opposing jaw, *about as much as the natural teeth yield in their sockets, thus avoiding the shock that would result from the teeth being rigidly held by a hard, non-elastic material.*"

The witness is then referred to the circular describing the defendant's process and to Hyatt's patents, in accordance with which the celluloid sets of teeth are made, and to specimens of such sets. (p. 53.)

I understand that the sets of teeth, Hyatt No. 3 and Hyatt No. 4, are made of a kind of solid collodion now called celluloid, and mineral teeth, and that they are made in either one or the other of the apparatus described in Letters Patent 152,232, or Letters Patent No. 121,522, substantially in the manner and of the materials which are described in the Patent 113,055. I have read all the patents and the circular referred to in the question and believe that I understand them.

I do not consider that Cummings' invention is dependent upon the chemical composition of the plate, any more than it depends upon the chemical composition of the artificial teeth. It is only necessary, in order to apply his invention, that teeth should be used possessing substantially the physical characteristics of artificial teeth, and that they should be imbedded in a plate possessing substantially the characteristics of a vulcanite plate for the purpose for which it is to be used. The physical characteristics of the substance which forms the plate, in order to fit it for holding artificial teeth, in substantially the manner described in Cummings' patent, are: first, capability of being formed or molded around the roots of the teeth and pins while in a soft

and plastic condition; and second, strength and elasticity when cold and hard, such as is possessed by whalebone, ivory, vulcanite and solid collodion, so that it shall be sufficiently strong and rigid for the purpose of mastication and at the same time elastic enough to yield slightly to the pressure of the jaw. The process described in the patents referred to in the question, as being practiced with celluloid and teeth, must necessarily result in an article of manufacture containing all the features that constitute, as before stated, the distinguishing characteristics of the vulcanite dental plate. I have examined many vulcanite dental plates, and a considerable number of solid collodion or "celluloid" dental plates, and after looking at and handling them, was unable to decide which were vulcanite and which celluloid; in fact I picked out, in several instances, celluloid as vulcanite, and vulcanite as celluloid; I then compared those composed of the one material with those composed of the other, and could distinguish no difference in their physical characteristics, except in their odor, and in the slight translucency possessed by solid collodion or celluloid, not deeply colored. The celluloid dental plate, made as referred to in the question, is in my opinion substantially the article of manufacture described and claimed in the Cummings reissue. The celluloid and the vulcanite plates both have the teeth supported by imbedding; both have a close joint between the teeth and the substance which supports them; both have sufficient strength, rigidity and elasticity; both of them as I am informed and believe, are unaffected by the fluids of the mouth, and usual foods and condiments; and both of them, by reason of being manufactured by moulding and pressure, without use of metal dies, and therefore without danger of alteration of such dies during stamping, are almost if not quite exact fits to the mouth and alveolar ridge. I am also informed that users cannot distinguish, when in use, sets of teeth made of vulcanite from those made of celluloid. I am of the opinion previously expressed as to the substantial identity of the two articles, although I know that celluloid is a different chemical compound from vulcanite, because I believe that the substantial resemblance must be sought in those points or characteristics which are brought into play in actual use, and not in characteristics which are unimportant in such use. In further support of this opinion, I state that solid collodion was described before the date of the Cummings original* patent as a substance which might be used in many manufactures where vulcanite had been used, and that I have seen it myself (although I cannot state that it was before the date of the Cummings patent), used for knife handles and cheap jewelry, as vulcanite was and is used. I further state that solid collodion, prior to the date of the Cummings patent, was obtained by evaporating out the solvent, and that such solvents were liquid solvents, such as ether; and that I have examined patents dated before the date of the Cummings patent which describe the mixture of camphor and other gums with collodion.

I do not understand that celluloid is compounded with sulphur, or has any sulphur in it; *I understand that celluloid is subjected to heat while in moulds to soften it, and make it fit the teeth perfectly by pressure, as the vulcanizable compound is, and that celluloid is hard when cold, hardening during the cooling.* A vulcanizable compound becomes of *a tarry consistency* while subjected to heat in the mold, and is hard when cold, after being subjected to the heat, but I do not know when it commences to harden, whether during the cooling or while at the highest heat; although I do know that *the final hardening takes place during the cooling* (p. 54).

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* See correction, page 60, of error, page 54.

Cross-Ques. 12. Was not your testimony in the Smith case based upon an understanding of the Cummings Patent, re-issue No. 1904, being only for a case or set of teeth, the base or plate of which was made of a vulcanizable compound, converted by the Goodyear process into vulcanite ?

Ans. I cannot say that it was : I noticed the word equivalent in the claims of the patent, but in studying the case before testifying, dismissed the word from consideration as far as the Smith case was concerned, because in that case the thing sued was admitted to be a vulcanite plate ; after that time my opinion was requested as to whether a case formed in part of rose pearl or celluloid would be an infringement of the patent ; and after considering the thing carefully for some days I came to the conclusion that it was.

Cross-Ques. 13. Is not the term "or its equivalent" in the re-issue No. 1904 restricted to equivalents of hard rubber or vulcanite, that is to compounds which are vulcanizable and have been vulcanized ?

Ans. No ; not as I understand it.

Cross-Ques. 14. Then what do you understand by the direction, is the re-issue No. 1904, which I quote:—"the soft rubber or gum, so inserted in the mould, is to be compounded with sulphur, rubber, etc., in the manner prescribed in the patent of Nelson Goodyear, dated May 6th, A. D. 1851, for making hard rubber, and is to be subjected to sufficient heat to vulcanize or harden it substantially as directed in that patent."

Ans. I understand that every patentee is obliged to describe clearly one way of carrying out his invention, in this case one way of making the new article of manufacture, which is the subject matter of the patent ; and that the words quoted are a part of the direction how to make a plate which, when complete, shall be composed of vulcanite and mineral teeth (p. 57).

The defendant introduced *no expert or other testimony* to meet the evidence of the complainant upon this point.

XV.

Nothing contained in the correspondence between the Commissioner of Patents and the patentee in the record of the proceedings in the Patent Office, antecedent to the grant of the patent, could limit the patentee to vulcanite and deny him protection against equivalents.

(*a.*) Such evidence is not admissible to vary the construction of the patent finally granted.

Upon the several hearings of the Gardner case this question

was fully passed upon. Mr. Justice Clifford, commenting upon the contention of the defendant that this patent "covers nothing but the use of hard rubber in making plates for artificial teeth," says:

"Unsupported as the theory of the respondent is by any "phrase or word contained in the claim or specification, it does "not seem to require any argument to refute it except to say "that the meaning of Letters Patent, like other grants or writ- "ten instruments, must be ascertained by the language em- "ployed, as applied to the subject matter.

"Much aid may be derived in construing the claim of a pat- "ent by referring to the descriptive part of the specification, "and reference may also be made, if need be, to the drawings "and Patent Office model; *but neither the correspondence be- "tween the Commissioner and the applicant nor the proceed- "ings in the Patent Office are admissible to enlarge, diminish "or vary the language of the claim.*

"Evidence to prove the state of the art is admissible and "expert testimony to aid in expounding and defining technical "words and phrases may be received, *but in all other respects "the rules for the construction of Letters Patent are the same "as those applied in construing other grants and written in- "struments* (4 Fisher 226, 227.)

(*b.*) There is nothing in the proceedings in the Patent Office that by any fair construction could, if admissible, restrict the scope of the patent.

As we have already pointed out, prior to the date of Cummings' invention, the process described by Dr. Wildman exhibited a plaster mould in two sections, the lower section being a model of the mouth, with, however, a gold or silver plate, formed by swaging between a die and counterdie, planted in it, the upper section containing the teeth precisely as in the mould described in the Cummings reissue. It was not necessary, therefore, for Dr. Cummings to describe the making of this plaster mould. *No person before Dr. Cummings ever filled that mould with any material in such a manner as to form the plate and gums with the teeth imbedded therein*, so that on the hardening of the substance composing the plate and gums,

"the teeth, gums and plate would all be connected, forming "as it were one piece."

In his original application for his patent, filed on April 12, 1855 (Complainant's Record, pages 164 and 165), he states his invention as follows:

"The method, hitherto practiced, of attaching artificial teeth to a metallic plate fitting to the roof of the mouth, is attended with many objections and inconveniences, as the plate, being hard and unyielding, naturally hurts the mouth, and in some degree impedes mastication and perfect articulation, while the expense of the metal employed prevents many from availing themselves of the advantages of artificial teeth.

"The present invention consists in *forming the plate and gums to which the teeth are attached* of rubber, or *some other elastic material*, so indurated as to be rigid enough for the purpose of mastication, and pliable enough to yield a little to the motions of the mouth, and *in one piece the teeth being imbedded* in the elastic material, while the said material is in a soft condition, and then baked with the gums and plate, so that the teeth, gums and plate will be all connected, forming, as it were, one piece.

"*a, a, a,* &c., in the drawings, represents the artificial teeth prepared in the usual manner.

"The plate and gums, *b, b, c, c,* are formed in one piece, and of rubber, or of rubber and the compounds commonly employed therewith, or of gutta percha, or *in fact of any elastic substance which can be reduced to a soft condition, and then vulcanized or hardened sufficiently to answer the purposes.*" And he claimed: "Forming the plate and gums in which the teeth are inserted in one piece of rubber (or other elastic material or materials), which can be hardened sufficiently for the purpose of mastication, and retain a portion of the elasticity, so as to yield a little to the motion of the mouth, as herein set forth, and for the purposes specified."

He filed a model at the same time, and the proof shows that previous to that time, he had made a number of perfect sets of teeth on a vulcanite base—among others, "Exhibit Flagg, No. 1" (p. 112), which is as perfect a set of teeth as can now be produced.

The Patent Office, however, rejected him on references to the use of pure gutta percha described by Delabarre, and to the use of soft vulcanized rubber, such as shoes are made of, for the purpose of an artificial palate (the organ which hangs in front of the throat). Dr. Cummings, willing to take a patent for anything he could get, amended his specification, and in his letter (Complainant's Record, page 166), says:

"In the originating this invention, Mr. Cummings supposed *that he was first in the use of mineral teeth, etc., with a gum which becomes plastic by heat and hardens by cooling; but he had always intended to use the vulcanized rubber as the best material*, and only put in gutta percha for the sake of extending his protection."

He then pointed out that pure unvulcanized gutta percha was

entirely useless for the purpose; that it would not make the article desired; that it would not make "the palate elastic;" and that it would not resist heat and acids, and he states that "its application to this purpose has long been abandoned as "impracticable:" and for the sake of getting a patent he stated his claim as follows (p. 167):

"I do not claim the use of gutta percha or of any material which is *merely* rendered plastic by heat and hardened by cooling in the manufacture of sets of artificial teeth; but what I do claim as my invention and desire to have secured to me by Letters Patent is the improvement in the manufacture of sets of mineral or other artificial teeth, which consists in combining them with a rubber palate and gums, which (after the insertion of teeth) are vulcanized by Goodyear's process or any other process, forming thereby a cheap, durable and elastic substitute for the gold plates, &c., heretofore used."

Even this narrow claim was refused on February 6, 1856, and finally, in 1864, he renewed his application *in the precise form in which it had originally been filed on April* 12, 1855 (p. 291). On April 7, 1864, the Patent Office suggested to him to amend his specification by confining it to "hard rubber, now called vulcanite," and suggested "a claim limited to the use of this material for this purpose." (Deft's Record, p. 292.)

Speaking of this renewed application, Mr. Justice Strong says (3 Otto., p. 492):

"This final effort was successful. The Office practically acknowledged that the prior rejection had been an error, and declared that in justice to his rights as an inventor, the admission of his claim, limited to his use of hard rubber or vulcanite, as he had before limited it, would not be objected to. Accordingly, the patent was granted on the 7th of June, 1864."

When the patent came to be granted *it was not so limited.* It was limited to nothing but hard rubber or vulcanite, *or its equivalent*, which was defined to be an elastic material, possessing certain qualities.

On June 7, 1864, the original patent was granted as it now appears upon the record (Complainant's Exhibit A, page 89) and Dr. Cummings in that patent points out that in carrying out his invention it is not necessary to employ vulcanite, but that his manufacture can be produced by moulding the base "*in fact of any elastic substance which can* "*be reduced to a soft condition, and then vulcanized or hard-*"*ened sufficiently to answer the purpose*" (p. 91); and he claimed: "Forming the plate and gums in which the teeth "are inserted in one piece of hard rubber or vulcanite, i. e.,

"*an elastic material, which can be hardened sufficiently for* "*the purpose of mastication and retain a portion of its* "*elasticity so as to yield a little to the motion of the mouth, as* "*herein set forth and for the purposes specified*" (p. 91), thus clearly showing what he understood to be the equivalent of the thing claimed in the patent.

It must be borne in mind that there are two kinds of gutta percha, one, unvulcanized gutta percha, that Dr. Cummings was aware, could not be hardened so as to answer the purpose (p. 167), and the other vulcanized gutta percha which makes vulcanite and can be and is now used for the purpose (p. 419, p. 421, p. 245, Q. 79).

Conclusion.

The evidence introduced by the defendant from the Smith case (pp. 293 to 583) is now valuable merely as showing the state of the art. The plaintiffs proved their *prima facie* case by the evidence of Hyatt, Warner, Bacon and H. B. Renwick (pp. 35 to 61). Mr. Renwick clearly proved and explained the infringement.

This prima facie case remains uncontradicted, as will be seen by an examination of the testimony of Hyatt, Colburn, Allen, Ira Starr and Alfred Starr, the only witnesses called to meet it (pp. 221 to 245).

No witness has undertaken to compare the manufacture of the defendant with the thing described and claimed in re-issue 1904, *and to deny their substantial identity.*

The decree of the Court below was therefore contrary to the evidence.

We submit that the decree of the Circuit Court should be reversed, with direction to enter a decree for complainant, according to the prayer of the bill, with costs to complainant.

B. F. LEE,
WM. HENRY CLIFFORD,
Of Counsel.

Supreme Court of the United States.

No. 67.

OFFICE SUPREME COURT U.S.
FILED
NOV 8 1880
JAMES H. McKENNEY, Clerk

The Goodyear Dental Vulcanite Company,

Appellant,

vs.

CHARLES G. DAVIS.

Appeal from the Circuit Court of the United States for the District of Massachusetts.

BRIEF FOR APPELLEE.

HENRY BALDWIN, Jr.,
WM. D. SHIPMAN,

Counsel for Appellee.

Supreme Court of the United States.

No. 67.

THE GOODYEAR DENTAL VULCANITE COMPANY, APPELLANT,
vs.
CHARLES G. DAVIS.

APPEAL FROM THE CIRCUIT COURT OF THE UNITED STATES FOR THE DISTRICT OF MASSACHUSETTS.

BRIEF FOR APPELLEE.

STATEMENT OF THE CASE.

The case of Smith *vs.* The Goodyear Dental Vulcanite Company *et al.* was decided in this court at the October Term of 1876, having been brought here by appeal from the Circuit Court of the United States for the District of Massacusetts, in which court Judge Shepley had sustained the Cummings patent, and adjudicated its infringement by the defendant in the manufacture of dental plates of hard rubber or vulcanite.

This court affirmed that decision.

93 U. S., 486.

Pending the appeal of that case, the Goodyear Dental Vulcanite Company filed a large number of bills in the First Circuit against dentists who were charged with infringing the same patent by the manufacture of dental plates of hard rubber or vulcanite, and also by making such plates of other materials, the general charge in the bills being supplemented as follows:

"And your orators further state and charge the fact to be, "that the said defendant has, as aforesaid, infringed upon "said letters patent by the making of sets of artificial teeth

"embedded in elastic bases moulded to fit the mouth, said "bases being composed sometimes of the elastic substance "known as vulcanite, and sometimes of the elastic substance "solid collodion, known by the trade-names of 'Rose Pearl' "and 'Celluloid,' all of the said sets of artificial teeth being "substantially the articles of manufacture described and "claimed in said reissued Letters Patent No. 1904."

Record, p. 7.

Special interrogatories were propounded in the bill, and the defendant was required to answer under oath as to

"1. Whether he has not made or caused to be made, or "used or sold, the plate of hard rubber or vulcanite, or its "equivalent, for holding artificial teeth, or teeth and gums, "substantially as described in said reissued Letters Patent "No. 1904, since the 17th day of July, 1866, and what num- "ber of such sets of artificial teeth," etc.

Record, p. 7.

The appellee answered the special interrogatories, under oath as required by the bill, and after stating that he had made plates of hard rubber or vulcanite under complainant's license up to the end of June, 1874, and that since the expiration of such license he had not made, used, or sold to others to be used, any plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth, or teeth and gums, substantially as described in said letters patent, Reissue No. 1904 (Record, p. 20), he proceeded as follows:

"And this defendant, further answering, denies that he has "infringed upon said letters patent, Reissue No. 1904, by "the making of sets of artificial teeth embedded in elastic "bases moulded to fit the mouth, said bases being composed "of the substance known by the trade-name of 'Celluloid,' "though he admits that he has made sets of artificial teeth "upon a base of the material known by the trade-name of "'Celluloid;' but he, further answering, denies that such sets "of artificial teeth are substantially the articles of manufac- "ture described and claimed in said reissued Letters Patent "No. 1904.

"And this defendant, further answering, denies that he has "infringed upon said letters patent, Reissue No. 1904, by "the making of sets of artificial teeth embedded in bases "moulded to fit the mouth, said bases being composed of "the substance known by the trade-name of 'Rose Pearl.' "And he further denies that sets of artificial teeth upon a "base of the material known by the trade-name of 'Rose "Pearl,' are substantially the articles of manufacture described "and claimed in said reissued Letters Patent No. 1904.

"And this defendant, further answering, is advised and "believes, and thereupon avers, that the substance known by "the trade-name of 'Celluloid' does not contain any caout-"chouc, india-rubber, gutta-percha, or other vulcanizable "gum, nor any sulphur or other vulcanizing ingredient; that "said material or substance called celluloid is not a vulcan-"izable compound, and is not vulcanized in the process of "manufacturing a dental plate, or a case or set of artificial "teeth, and is not an equivalent of hard rubber or vulcanite, "nor within the claim of said letters patent, Reissue No. "1904.

"And this defendant so as aforesaid, further answering, "says, that he is informed and believes, and thereupon avers, "that said substance, known by the said name of celluloid, "was invented by John W. Hyatt, Jr., and Isaiah Smith "Hyatt, who also invented a certain process or method of "manufacturing said substance, for which inventions they "obtained letters patent of the United States, as follows, to "wit: No. 105,338, dated July 12, 1870; reissued to the Cel-"luloid Manufacturing Company, mesne assignees of said "John W. Hyatt, Jr., and Isaiah S. Hyatt, June 23, 1874, "Reissue No. 5928. Also that Letters Patent No. 113,055, "dated March 28, 1871, were issued to the Albany Dental "Plate Company, assignees of said Isaiah S. Hyatt and John "W. Hyatt, Jr., and Jesse A. Perkins, for an improvement "in forming said material made by the aforesaid patented "process into a blank or plate, for use as a dental base. "Also, that Letters Patent No. 121,522, dated December 5, "1872, were issued to the said Albany Dental Plate Com-

"pany, as assignees of said John W. Hyatt, Jr., and said "Isaiah S. Hyatt, for an improved apparatus for moulding "said dental plates of said substance designated as celluloid. "And that Letters Patent No. 152,232, dated June 23, 1874, "were issued to the Celluloid Manufacturing Company, as- "signees of said Isaiah S. Hyatt and John W. Hyatt, Jr., for "improved apparatus and process for moulding said sub- "stance called celluloid. And this defendant, further an- "swering, says, that he is informed and believes, and there- "upon avers, that the celluloid used by him as aforesaid was "made and shaped by the processes described in said Letters "Patent No. 105,338, Reissue No. 5928, and No. 113,055; "and he further says, that in making dental plates of said "substance, he has used the processes and substantially the "apparatus described in said Letters Patent No. 113,055, No. "121,522, and No. 152,232; and this defendant, further an- "swering, says, upon information and belief, that the cellu- "loid blanks or plates which he has used as aforesaid were "made under the sanction of said letters patent, and sold for "such use under the authority and license of the Celluloid "Manufacturing Company, the owners of said letters patent." Record, pp. 20, 22.

And upon the general charge of infringement, the defendant's answer affirmatively raises the issue of non-infringement by the manufacture of dental plates of celluloid, as follows:

"XIII. That the said reissued Letters Patent No. 1904 "describe and specify and claim the plate of hard rubber or "vulcanite, or its equivalent, for holding artificial teeth, or "teeth and gums, substantially as described; that is, when "made by the process described, which process is an entirety, "and includes the conversion of the vulcanizable plastic com- "pound into the vulcanized product; and that the substance "called celluloid not being a vulcanizable compound, and not "being vulcanized or converted into a vulcanized compound, "it is not an equivalent of hard rubber or vulcanite, and a "plate of celluloid for holding artificial teeth, or teeth and "gums, is not an equivalent of the plate of hard rubber or

"vulcanite for holding artificial teeth, or teeth and gums, "substantially as described in said Reissue 1904, nor is the "manufacture, use, or sale of such plates made of celluloid "an infringement of said Reissue No. 1904.

"XIV. That the process of making the plate of celluloid "for holding artificial teeth, or teeth and gums, or the pro- "cess of making a set of artificial teeth on a base of celluloid, "is not the same, or substantially the same, as the process of "making the plate of hard rubber or vulcanite, or its equiva- "lent, for holding artificial teeth, or teeth and gums, substan- "tially as described in said reissued Letters Patent No. 1904, "or the process of making a set of artificial teeth on a base "of hard rubber or vulcanite or its equivalent; and that by "reason of the differences between said processes respectively "as well as by reason of the differences between celluloid "and hard rubber, or vulcanite or its equivalent, the manu- "facture, use, or sale of sets of artificial teeth on a base of "celluloid is not an infringement of said reissued Letters "Patent No. 1904.

"XV. That the material called celluloid being a new sub- "stance or compound, not containing either of the essential "ingredients of hard rubber or vulcanite, or its equivalent, "nor any substitute for either of said ingredients, performing "the functions of the rubber or of the sulphur, and said new "substance or compound, celluloid, not being known at the "date of said Cummings' alleged invention of the alleged "improvement patented in said reissued Letters Patent No. "1904, and not being known at the date of said Cummings' "alleged invention, nor at the date of said reissued Letters "Patent No. 1904, nor at the date of said original Letters "Patent No. 43,009, as a proper substitute for hard rubber or "vulcanite, or its equivalent, the use of said new substance or "compound as a base for artificial teeth is not an infringement "of the said reissued Letters Patent No. 1904.

Record, pp. 29, 30.

The general replication was filed to the defendant's answer, July 26, 1876.

Record, pp. 30, 31.

And in September following a stipulation was entered into between counsel, applying to a great number of specified suits, on the understanding that the defendants in all of them made their celluloid sets of teeth as described in proofs then taken; that a printed copy of the same proofs should be filed in each district in which a suit was pending upon the same pleadings; that the decision of any one of said causes should stand as the decision in all of them; that the complainant might bring any one of said causes to hearing in any district upon similar pleadings and upon said proofs, the decision of one to determine all of the causes mentioned; and making provision for taking proofs, etc.

Record, pp. 32, 33.

Under this stipulation the complainants selected the case of this appellee in the District of Massachusetts, and it was argued upon pleadings and proofs before Judge Shepley, in October, 1876.

This, therefore, like the Smith case as to rubber, was a test case as to celluloid.

In October, 1877, Judge Shepley filed his decision dismissing the bill. His opinion shows that he reached his conclusions with due regard to the opinion of this court in the Smith appeal.

Record, p. 583.

The question involved in this case is thus raised by the pleadings in the court below, and the proof of infringement consists in the admission in the answer that the defendant had made plates of "celluloid." The method of making these celluloid plates is described in the proofs adopted in the stipulation of September 14, 1876.

Record, p. 31.

The record of the Smith case was, by stipulation, made available to both parties, and the greater portion of it was introduced by one side or the other, so that the state of the art is substantially reproduced from that record, as is also the history of Cummings' invention and patent.

Record, p. 109.

Brief of Argument.

THE COURT BELOW DID NOT ERR IN FINDING THAT "THE USE "OF CELLULOID IN THE MANUFACTURE OF SETS OF ARTIFICIAL "TEETH, AS PRACTISED BY THE DEFENDANTS, AND THE MANUFAC- "TURE ITSELF, THE SET OR PLATE OF TEETH, DIFFER AS MUCH, "BOTH AS TO PROCESS AND PRODUCT, FROM THE PROCESS AND "PRODUCT DESCRIBED AND CLAIMED IN THE CUMMINGS PATENT, "AS THAT PROCESS AND THAT PRODUCT DIFFERED FROM THOSE "PREVIOUS MANUFACTURES WHICH EXISTED BEFORE THE CUM- "MINGS INVENTION, AND WERE UNSUCCESSFULLY RELIED UPON AS "ANTICIPATING IT."

Record, pp. 585, 586.

First.

The invention claimed and patented by Cummings is "a set "of artificial teeth, as a new article of manufacture, consisting "of a plate of hard rubber, with teeth, or teeth and gums, "secured thereto in the manner described in the specification, "by embedding the teeth and pins in a vulcanizable compound "so that it shall surround them while it is in a soft state before "it is vulcanized, and so that when it has been vulcanized the "teeth are firmly and inseparably secured in the vulcanite, and "a tight joint is effected between them, the whole constituting "but one piece." (93 U. S., 494.)

The conclusion and claim of the Reissue No. 1904 is—

"*Having thus described the method I have used for making and "using said hard rubber or vulcanite plates, what I claim herein "and desire to secure by letters patent is—*

"*The plate of hard rubber or vulcanite, or its equivalent, for "holding artificial teeth, or teeth and gums, substantially as de- "scribed.*"

Record, p. 99.

This patent, Reissue No. 1904, having been already passed upon by this court (93 U. S., 486), we have only to cite the construction given to this claim in that case.

"The invention, then, is a product or manufacture made in a "defined manner. It is not a product alone separated from the "process by which it is created. The claim refers in terms to "the antecedent description, without which it cannot be under- "stood. The process detailed is thereby made as much a part "of the invention as are the materials of which the product is "composed." (93 U. S., 493.)

* * * * * * * * * *

"If, then, the claim be read, as it should be, in connection "with the preceding part of the specification, and construed in "the light of the explanation which that gives, the invention "claimed and patented is 'a set of artificial teeth, as a new article "'of manufacture, consisting of a plate of hard rubber, with teeth, "'or teeth and gums, secured thereto in the manner described in "'the specification, by embedding the teeth and pins in a vulcan- "'izable compound so that it shall surround them while it is "'in a soft state before it is vulcanized, and so that when it has "'been vulcanized the teeth are firmly and inseparably secured "'in the vulcanite, and a tight joint is effected between them, "'the whole constituting but one piece.'" (93 U. S., 494.)

Strictly following this confirmation of his opinion in the Smith case, Judge Shepley, in the case at bar, says:

"The product, the new article of manufacture patented, was a "set of artificial teeth consisting of a plate of hard rubber or vul- "canite, with teeth, or teeth and gums, secured thereto in the "manner described in the patent, by embedding the teeth and "pins in the vulcanizable compound so that it shall surround the "teeth and pins while the compound is in a soft state before it "is vulcanized, so that when the compound is vulcanized the "teeth are firmly secured by the pins embedded in the vulcan- "ite, and there is a tight joint between the vulcanite and the "teeth. This product was a new product, not alone because it "substituted one material for another, the material, vulcanite "rigid enough for purposes of mastication, yet pliable enough to "yield a little to the mouth, and at the same time light and inex- "pensive, in place of the hard, unyielding, expensive, and heavy "metals previously used, but also in the additional fact that it "was made by a process which, taken as a whole, was a new

"process, by the use of which process 'the teeth can easily be "'baked into the gums, which form one piece with the plate.'"
Record, p. 584.

Turning now to the specification of the patent, Reissue No. 1904, we find that it refers to another patent, of a date earlier than Cummings' invention, for the instructions which are to enable the dentist to make such a set of teeth as is the subject of the claim (under these authorities), out of the materials indicated.

"The soft rubber or gum so inserted in the mould is to be "compounded with sulphur, rubber, etc., in the manner prescribed "in the patent of Nelson Goodyear, dated May 6th, A.D. 1851, "for making hard rubber, and is to be subjected to sufficient "heat to vulcanize or harden it, substantially as directed in that "patent. It is also to be colored, in imitation of the natural "gums, by mixing it with vermilion or other suitable coloring "matter while in the soft state. After the plate has been heated "sufficiently to harden it, or convert it into hard rubber, or, "'vulcanite,' so called, the mould is removed, and the plate is "polished ready for use."
Record, p. 99.

Again, turning to this patent of Nelson Goodyear's, which is thus incorporated in the Cummings patent, we find the following essential instructions as to the production of the Cummings plate: Goodyear recites that he has invented "a new "and useful improvement in the preparation and manufacture "of caoutchouc or india-rubber," which "consists in so com-"pounding caoutchouc with other substances that the composi-"tion thus formed, *when subjected to the heating or curing pro-"cess described in the patent of Charles Goodyear, dated June 15th, "1844, and in the reissue of said patent, dated December 25th, "1849, will form a hard, stiff substance, hitherto unknown.*"

* * * * * * * *

"The indispensable ingredients used in my composition are "caoutchouc and sulphur, and when only these two ingre-"dients are used, the best proportion will be about equal parts

"by weight of each of them; indeed, a much less proportion of "sulphur will not suffice. But though the combination of so "large a proportion of sulphur with the caoutchouc will pro- "duce, when cured, a hard substance, a still better result will "be obtained by the introduction of magnesia, lime, carbonate "of magnesia or lime, or sulphate of magnesia or lime, into the "composition; in which case the following proportion will be "found a highly advantageous one, viz.: One pound of caout- "chouc, half a pound of sulphur, and half a pound of magnesia "or lime, or carbonate of magnesia or lime, or sulphate of "magnesia or lime.

"The proportions specified in both of these compounds may "be considerably varied without materially changing the "result; but in no case will a much less quantity of sulphur "than four ounces to every pound of caoutchouc be sufficient, "in which respect particularly my compounds differ very essen- "tially from every other composition of india-rubber in use, as "in all other rubber compositions the least quantity of sulphur "that will suffice to cure the article is aimed at."

* * * * * * * *

"Rosin, oxides or salts of lead, or zinc of all colors, and "other similar substances, both mineral and vegetable, may be "added in small quantities to either of the compounds for the "purposes of polish, color, making the admixture work more "easily," etc.

* * * * * * * *

"The ingredients may be mixed and incorporated with one "another in the usual methods employed in the manufacture of "compounds of caoutchouc. When mixed, the compound may "be either rolled into sheets by means of calendering rollers, or "formed by moulding, or other well-known processes, into any "desired shape, for the purpose of being used in the manufac- "ture of such articles as the same may be applicable to. *The "compound must then be subjected to the heating or curing process "already mentioned, as patented by Charles Goodyear, and to "which reference is hereby made for a particular description thereof; "in most cases the heat will be required to be raised as high as 260°*

"*or 275° Fahrenheit, and the time of exposure to the heat will "range from three to six hours, or even longer.*"

Record, pp. 442, 443.

We are here again referred to a still earlier patent from which we are to obtain the ultimate requirements of the Cummings specification which thus collaterally embodies Charles Goodyear's curing process as part of Nelson Goodyear's vulcanizing process.

This patent of Charles Goodyear's, dated June 15th, 1844, is at pp. 255, 257, of the record, and the reissue of that patent under date of December 25th, 1849, is at pp. 258, 262. So far as affects the present question it is only necessary to observe that the heating or curing process thus imported into the Cummings patent consists in subjecting the compound of rubber and sulphur to the action of a high degree of artificial heat, varying from 212° to 350° Fahrenheit, for the best effect approaching as near as may be 270° as a general rule, and the period of exposure to this heat ranging from two to six hours.

Record, p. 261.

This curing process being modified, by the Nelson Goodyear patent, to an exposure of the composition to a heat ranging from 260° to 275° for a period ranging from three to six hours.

Record, p. 443.

Here then, and only here, at this second remove from the Cummings specification, we find the essentials of the manufacture of the plate of hard rubber or vulcanite, which essentials consist of

I. A composition of which the *indispensable* ingredients are rubber and sulphur.

II. Definite proportions of these two indispensable ingredients, these proportions varying from a maximum of about equal parts by weight (which proportion must be substantially maintained when only these two indispensable ingredients are used) to a minimum of about four ounces of sulphur to one pound of caout-

chouc, this being about the least proportion of sulphur that will be sufficient *in any case.*

III. Coloring matters in small quantity.

IV. Moulding into the desired shape.

V. The heating or curing process of Charles Goodyear, in most cases demanding a heat as high as 260° or 275° Fahrenheit.

VI. An exposure to the heat for from three to six hours or even longer.

Not one of these essentials was invented by Cummings.

THE MATERIAL OF WHICH THE CUMMINGS PLATE OR SET OF TEETH IS COMPOSED BEING NO PART OF HIS INVENTION, WHAT WAS NEW IN THE PROCESS DESCRIBED IN THE REISSUE NO. 1904?

In 93 U. S., 493, this court held: "In carrying out the purpose proposed the materials employed were all old. The "teeth, the wax, the plaster, the moulds, the soft rubber and "the hard rubber, were none of them new. It is also true that "the steps in the process were not all new. Plaster had been "used for formation of moulds. The process of forming a "plate by the use of such moulds was well known, and so was "the process of converting a vulcanizable compound into vulcanite by heating it and allowing it to cool in moulds. But "the process of Dr. Cummings extended beyond the use of "known materials and the employment of the processes mentioned. *It was vulcanizing soft rubber in a mould and in contact with artificial teeth, inserted in place into it while it remained "in a soft condition.* It was well described by the Circuit Judge "as 'the making of a vulcanite dental plate out of a vulcanizable compound, into which the teeth were embedded in its "'plastic condition, and the rubber compound, with the teeth "'thus embedded in it, afterwards vulcanized by heat, so that "'the teeth, gums, and plate should be perfectly joined without "'any intervening crevices and the plate should possess the "'quality of hard rubber or vulcanite.'"

Again (93 U. S., 499–500), "The first specification describes

"*or 275° Fahrenheit, and the time of exposure to the heat will "range from three to six hours, or even longer.*"

Record, pp. 442, 443.

We are here again referred to a still earlier patent from which we are to obtain the ultimate requirements of the Cummings specification which thus collaterally embodies Charles Goodyear's curing process as part of Nelson Goodyear's vulcanizing process.

This patent of Charles Goodyear's, dated June 15th, 1844, is at pp. 255, 257, of the record, and the reissue of that patent under date of December 25th, 1849, is at pp. 258, 262. So far as affects the present question it is only necessary to observe that the heating or curing process thus imported into the Cummings patent consists in subjecting the compound of rubber and sulphur to the action of a high degree of artificial heat, varying from 212° to 350° Fahrenheit, for the best effect approaching as near as may be 270° as a general rule, and the period of exposure to this heat ranging from two to six hours.

Record, p. 261.

This curing process being modified, by the Nelson Goodyear patent, to an exposure of the composition to a heat ranging from 260° to 275° for a period ranging from three to six hours.

Record, p. 443.

Here then, and only here, at this second remove from the Cummings specification, we find the essentials of the manufacture of the plate of hard rubber or vulcanite, which essentials consist of

I. A composition of which the *indispensable* ingredients are rubber and sulphur.

II. Definite proportions of these two indispensable ingredients, these proportions varying from a maximum of about equal parts by weight (which proportion must be substantially maintained when only these two indispensable ingredients are used) to a minimum of about four ounces of sulphur to one pound of caout-

chouc, this being about the least proportion of sulphur that will be sufficient *in any case.*

III. Coloring matters in small quantity.

IV. Moulding into the desired shape.

V. The heating or curing process of Charles Goodyear, in most cases demanding a heat as high as 260° or 275° Fahrenheit.

VI. An exposure to the heat for from three to six hours or even longer.

Not one of these essentials was invented by Cummings.

THE MATERIAL OF WHICH THE CUMMINGS PLATE OR SET OF TEETH IS COMPOSED BEING NO PART OF HIS INVENTION, WHAT WAS NEW IN THE PROCESS DESCRIBED IN THE REISSUE NO. 1904?

In 93 U. S., 493, this court held: "In carrying out the pur-"pose proposed the materials employed were all old. The "teeth, the wax, the plaster, the moulds, the soft rubber and "the hard rubber, were none of them new. It is also true that " the steps in the process were not all new. Plaster had been "used for formation of moulds. The process of forming a " plate by the use of such moulds was well known, and so was "the process of converting a vulcanizable compound into vul-" canite by heating it and allowing it to cool in moulds. But "the process of Dr. Cummings extended beyond the use of "known materials and the employment of the processes men-"tioned. *It was vulcanizing soft rubber in a mould and in con-" tact with artificial teeth, inserted in place into it while it remained " in a soft condition.* It was well described by the Circuit Judge "as 'the making of a vulcanite dental plate out of a vulcaniza-"'ble compound, into which the teeth were embedded in its "'plastic condition, and the rubber compound, with the teeth "'thus embedded in it, afterwards vulcanized by heat, so that "'the teeth, gums, and plate should be perfectly joined without "'any intervening crevices and the plate should possess the "'quality of hard rubber or vulcanite.'"

Again (93 U. S., 499–500), "The first specification describes

"a set of artificial teeth having a hard rubber plate made by a "process substantially the same as that indicated in the later "patent. The description of the process is not quite so minute, "but it is sufficiently full to be understood and to enable an "operator to make the manufacture. Certainly it is not "another process; and as the result is the same, it is impossi- "ble to hold that the reissued patent is for a different invention "from the one protected by the original patent. *It is true the "specification of the reissue describes also another process not de- "scribed in the specification of the first,—namely, a mode of mak- "ing the moulds,—but that is not claimed as a part of the inven- "tion.*"

THE VULCANIZABLE COMPOUND AND THE MODE OF VULCANIZING IT BEING OLD, AND THE PROCESS OF FORMING THE MOULDS IN WHICH THE VULCANIZABLE COMPOUND WAS SUBJECTED TO THE VULCANIZING TREATMENT BEING OLD, WHEREIN DOES THE CUMMINGS PROCESS OF FORMING THE PLATE OF HARD RUBBER DIFFER FROM OTHER PRIOR PROCESSES IN WHICH SETS OF ARTIFICIAL TEETH WERE FORMED OF OTHER MATERIALS IN SUCH MOULDS?

In his opinion in this case, Judge Shepley says, still in strict conformity with the opinion of this court as above cited:

"The next question to be considered is, What was there new "in the described process? The whole process of forming "and making a set or case of teeth, including the plate, gums, "and teeth, is fully described in the Cummings patent, and "this process is so fully described in the case of Vulcanite "Company *vs.* Smith,* that it becomes unnecessary to repeat "it here. It is sufficient to state that in view of the state of "the art there was nothing substantially new in that process "until we reach this part of the description: 'The teeth are "'provided with pins projecting therefrom in such manner "'that the rubber which is to constitute the plate will close "'around them, and by means of them hold or secure the "'teeth permanently in position. *The plaster mould with the*

* 1 Holmes, 356, 357.

"'*teeth adhering therein, as just described, is now filled with soft*
"'*rubber, a little at a time, pressed in with the finger, or in any*
"'*other convenient way; and care is to be taken that the rubber*
"'*is made to completely fit into the cavities, and around the pro-*
"'*tuberances, including the pins, and is filled in to the thickness*
"'*or depth desired to form the plate. I then lock the rubber plate*
"'*in position by shutting the other half of the plaster mould over*
"'*it, to insure its retaining its exact form while warming, and*
"'*then heat or bake it in an oven, or in any other suitable*
"'*way.* The soft rubber or gum, so inserted in the mould,
"'is to be compounded with sulphur, rubber, etc., in the
"'manner prescribed in the patent of Nelson Goodyear,
"'dated May 6, A.D. 1851, for making hard rubber, and is to
"'be subjected to sufficient heat to vulcanize or harden it,
"'substantially as directed in that patent. It is also to be
"'colored in imitation of the natural gums, by mixing it
"'with vermilion, or other suitable coloring matter, while
"'in the soft state. After the plate has been heated suffi-
"'ciently to harden it or convert it into hard rubber or "vul-
"'"canite," so called, the mould is removed, and the plate is
"'polished ready for use.'"

Record, pp. 584, 585.

We thus have the basis of fact upon which the court below founded its conclusion of law, and held that the appellee had not infringed this patent by making dental plates of celluloid, and it is respectfully submitted that there was no error in that conclusion.

THE STATE OF THE ART.

The record shows that prior to May 14th, 1852, the date of Cummings' caveat, and the earliest date that can be assigned to his invention, dental plates or sets of artificial teeth had been moulded from three classes of materials:

I. Fusible metals, melted and poured into the mould in which the teeth were placed.

II. Vitrifiable or silicious compounds, which were moulded upon the plate in the biscuit state and afterwards baked, and so converted into porcelain.

III. Plastic substances, softened by heat and moulded while thus softened.

As early as 1850 we find moulds used and described in printed publications, with the teeth held in position and the pins projecting from the teeth, identically as used to-day.

Record, pp. 516, 520.

FIRST.

The Fusible Metal Plates.

These were made in two ways: in one the entire base of the set of teeth was composed of tin; in the other a gold or silver base-plate was struck up in dies, and tin was employed to connect the teeth and the base-plate.

In making the entire plate of tin, the mould was prepared precisely as described in the Cummings reissue, the teeth provided with pins being held in the proper position for the metal to flow about and around them.

Record, pp. 516, 520.

The mould thus prepared was then closed and the two parts confined together, and heated up to the heat of fusing tin, when the melted tin was poured into the mould, through sprew-holes, until the mould was full, the tin embracing the necks of the

teeth, and being also secured by the platina pins embodied in the teeth.

Hawes, pp. 296, 297.

Royce, pp. 305, 307.

Hawes produces such a set of teeth made by him in 1850, and which was worn for about ten years.

Deft.'s Exhibit Geo. E. Hawes No. 2.

Another was worn by his mother for seven or eight years.

Pp. 301, 302.

It is true that in Smith *vs.* Goodyear Dental Vulcanite Company this court held, as to this manufacture, that "it was soon "abandoned, and it may properly be considered as an abandoned "experiment" (93 U. S., 498), but it is proper to point out here that the tin plate is now referred to and relied upon in connection with appellant's contention for an expanded construction of the claim, which construction would make the Cummings patent include this process of making the tin plate, if it would not include the plate itself.

In this view it is respectfully submitted that, whatever may be the place assigned to the tin base, its abandonment was an abandonment to the public, or its use was such as to preclude any subsequent inventor from maintaining a claim that would comprise it. The publications proved in the record are such as establish a state of the art which must be excluded from any valid claim under a later invention.

The Cummings patent was granted under the Act of 1836, the 15th section of which provides (5 Statutes at Large, 123):

(1) That the defendant in a patent suit may plead and prove that the patentee was not the original and first inventor or discoverer *of the thing patented, or of a substantial and material part thereof claimed as new.*

(2) *Or that it had been described in some public work anterior to the supposed discovery thereof by the patentee.*

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* * * * * * * *

IN EITHER OF WHICH CASES judgment shall be rendered for the defendant; . . . *providing* that a prior knowledge or use in a foreign country shall not invalidate the patent, "it not appear-"ing that it (the thing patented) had before been patented *or de-*"*scribed in any printed publication.*"

These defences provided by this statute, in force when the Cummings patent was granted, and constituting the law under which his rights are to be adjudicated, are independent of each other,—that is to say, a prior knowledge or use of the thing patented can be effectually established and will present a perfect defence, although there has been no patent and no publication, and, on the other hand, a sufficient description in a public work can be effectually established and will present a perfect defence, although no instance of use may be shown.

Webster's Patent Cases, p. 718. *Note.*

Curtis on Pats., 4 Ed., §§ 376, 378.

Cohn *vs.* Corset Co., 93 U. S., 377.

In this case (as in the Smith case) the answer sets up these two defences separately, specifying not only that Hawes, Royce, Wildman, and others had used the thing patented, or a substantial and material part thereof claimed as new, at certain places designated, prior to the supposed discovery, but also specifying certain printed publications, in which the thing patented, or a substantial and material part thereof claimed as new, had been described, and giving the volume and the page of each of such works, all of which were duly proved.

14 How., 223, 224.

Under these pleas the proofs show that Hawes did make dental plates on the tin base *by the process* so well understood and so fully admitted by the complainants as identical with that described in the Cummings reissue; and that the plates so made were used in some instances ten years, in some seven or eight years, and that Royce made at least three plates by this process.

Coffin *vs.* Ogden, 18 Wall., 120.

In cross-examining Dr. Hawes the complainants also prove that Dr. Schaffer made such a plate before 1850, and that one Fisk used such a plate so made by Hawes in 1849, and that Dr. Hawes' mother used one for years.

Record, pp. 301, 302.

P. & T. R. R. Co. *vs.* Stimpson, 14 Peters, 461.

Wildman practised the process in 1851, having acquired the knowledge of it in 1850 from the publication made by Hawes in the *American Journal of Dental Science.*

Record, p. 345.

And as late as 1862, complainant's witness Rushmore set teeth upon tin by the same process of moulding or casting.

Record, p. 151.

Now, while it may be true that these tin plates did not possess all of the desirable qualities to render *their use* popular, the Cummings patent does not depend upon *the use* of the thing made, nor upon the *behavior in use* of the thing made, and cannot be supported upon merely the properties involved in its *use.* If we proved a vulcanite dental plate *made* by the process, —whether in actual use or simply *in existence* early enough, or even *described* in a public work with sufficient fullness to enable us to *make* it,—the law does not require us to prove that it was *used*, or that in the latter case it was even made. It is enough under the first of the above-quoted defences to establish the fact that the thing was *known* to, *or* used by, such and such a person; or under the second, that it was described in such and such a public work.

So, we have the tin plate made, and the process practised long prior to the Cummings invention. What further does the strictest construction of the statutes demand? How far have our courts gone in demanding something more than the mere construction of the thing relied upon? We, of course, premise that it must not be a secret knowledge or use, nor a concealed invention; nor an experiment, merely showing that the prior thing did *not* possess the capabilities of any use; but beyond

these qualifications we submit that it is sufficient to show that the thing was made, and was made known to divers persons; that it was not only capable of use, but was used for a series of years, that it was made and sold in the way of business, and that it was engrafted upon the stock of common knowledge by the publication far and wide of the thing made, of the way of making it, and of its behavior in use; its advantages and disadvantages,—its merits and its defects.

The witnesses prove that the tin plate is heavy,—but they prove that weight is no objection: that in lower sets it is an actual advantage; nay, so essential that plates—lower sets—of rubber are actually *loaded* with metal merely to get weight,—the rubber being too light.

Record, p. 235, Q. 30.
p. 299, × Q. 30.
p. 352, × Q. 28.
p. 153, × Q. 118, 120.

Another objection urged against the tin plate is that tin *shrinks*. But so does rubber.

Nute, Record, p. 195, × Q. 86.

The expense of the tin base is not greater than that of the rubber base.

It is proved, too, in this case that you find crevices in vulcanite plates, and that secretions of particles of food are found in the vulcanite plates, two of the gravest objections urged against the tin plates.

Nute, p. 196.

Exhibits Nute No. 2 and Nute No. 3.

Not to extend these comparisons, we will assume that it is proved that the tin plates were made and used by the public,—subject to all the objections attending their use,—and that they were described in public work so fully that they could be made from the published description. In such case what is the law?

In Seymour *vs.* Osborne, this court held (11 Wall., 551) that the single machine which was relied upon, as constructed, was merely an experiment, and that it was *never reduced to practice*

as an operative machine: there was no positive evidence that it was ever used, *or that it was capable of any beneficial use.* Yet, even in that case, the court says that where an experimental machine, *before it was reduced to practice*, was broken up and laid aside as something *incomplete*, this only amounts to a deserted invention; *provided* it appears those acts were done without any intention of resuming the experiments and restoring the machine with a view to apply for letters patent.

No stronger case than this is recalled to mind. It goes further than any other in view of the facts which, in that case, showed that the machine was actually shipped for transportation to some place of trial and returned, and for some time remained at the shop. It can scarcely be presumed that if this machine had been produced at the hearing, and shown to embody the patented invention, it would not have been a good defence. The proof did not show even that it was capable of use.

The only other case presenting any ground for argument against the tin plate process is Whiteley *vs.* Swayne, 7 Wall., 685. The syllabus of the reporter is *entirely* aside from the point in the case itself as stated. The facts are these: In 1850, Dinsmore applied for a patent, obtained it in 1851, and reissued it in 1852. He had built a machine in 1850, and tested it that year. In 1851 he made twenty-one machines, and in 1852 some sixty of them. In 1852, *three months after Dinsmore's patent had issued, Steadman filed a caveat* for a different kind of a machine, and obtained his patent in 1854. Under this patent of 1854 the assignee of Steadman sued Dinsmore, and proved that in 1854 (1850?) he had made an experimental machine, and tried it in a clover-field. He did not even prove that he did this as early as Dinsmore made his machine of 1850.

The court found that Steadman's improvements "*never* went "into *any* useful or practical operation, and nothing more was "heard of them from Steadman, or any other person, for a period "of six years."

And the true principle announced, as relating to abandoned experiments, is this,—that if, under the circumstances of that case, Dinsmore had not been prior to Steadman, but had only taken up the invention where Steadman left it, and perfected it, *and adapted it to actual use*, he would not have been anticipated, or his patent invalidated, by what Steadman had done.

But suppose again, that Steadman, instead of abandoning his invention for six years, during which nothing was heard of it, had worked his clover harvester for six or eight years, would what the court said have been true then? would he not then have been held to have reduced the improvements to actual use?

It seems unnecessary to cumulate authorities on the other side of the proposition, but we must not turn to those without first saying that in all the cases, such as Cahoon *vs.* Ring, 1 Cliff., 609, 610, it will be found that, after even an experimental reduction to practice, abandonment becomes a very nice question, and when the reductions to practice are not only multiplied in number, but continued for a series of years, there has never been a case in which abandonment was found by the court *in favor* of a patentee, though there are many cases where under these multiplications of experimental machines abandonment has been decreed against the patentee and in favor of the public, even with unchallenged novelty in the improvements.

In Cahoon *vs.* Ring, so many conditions are specified as to the points to be considered in determining the fact of abandonment that the case presents scarcely as strong an argument for the other side as it presents for this defendant, who establishes so many facts of use, knowledge, and communication to the public.

And *per contra*, the case of Coffin *vs.* Ogden, 18 Wall., 120, citing Gayler *vs.* Wilder and Reed *vs.* Cutter, leaves nothing to be added to the simple statement that here it is proved that Hawes and Royce both made tin plates by the process de-

scribed, capable of working and complete; that such plates were made by more than two persons and worn by more than five persons; that they were thus tested and shown to be successful (for surely no greater proof of usefulness than seven or eight years' use in the mouth could be required); and these facts, even aside from the publications, bring this case within the severest legal tests which can be applied to it.

In the Fire Extinguisher case, Judge McKennan gave *decisive* weight to a reduction to practice which was only an *experiment in public*, because there had been a rejected application for a patent; and a rejected application cannot have the force of a publication such as we have in Hawes and Royce's article of 1850, and in connection with which we have their repeated instances of use. This case is therefore much stronger than that in which the Fire Extinguisher patent (6 Pat. Off. Gaz., page 34) was adjudged to have been anticipated.

To hold the tin plate and the tin plate process an unsuccessful or an abandoned experiment, would either be actually discarding the proofs in our record as to the facts, or actually reversing the application to those facts of what this court has determined as to the law.

We therefore submit that in relegating the tin base to the category of abandoned experiments this court has not intended to decide that it may be included in a claim *against* the public, and as to the tin base process, we understand the court to have held it to be established.

It is one thing to hold that the tin base did not anticipate the vulcanite plate, but it would be a very different thing to hold that the process of moulding such a plate could be comprised in the Cummings claim, the proofs and publications of that process to the contrary notwithstanding.

The gold or silver plate, with tin poured around the teeth to connect them with the plate, is proved to have been made by the same process as that employed in making the tin plate, except that the gold or silver plate was struck up in dies and

placed in the Hawes mould, so as to take the place of the tin in part.

Wildman, pp. 345, 347.

Such a plate, made in 1851, and worn for five years, is in the case.

Defendant's Exhibit E. W. No. 13.

SECOND.

Vitrified Plates of Silicious Compounds.

These are known as continuous gum sets of artificial teeth.

The process of their manufacture was patented, under date of December 22d, 1851, to John Allen, then of Cincinnati, Ohio.

Allen's specification is as follows:

I construct my plates and arrange the teeth thereon in the usual way. I then apply the cement in a plastic state upon the outside, between and around the base of the teeth, so as to form an artificial gum upon the teeth and plate. The teeth and gum are then covered with a mixture of asbestos and plaster of Paris, mixed with water and reduced to a plastic state. The teeth being thus covered, the wax is removed from the inside of the teeth, and the cement is applied thereupon, and also upon the plate, so as to fill up all the interstices around the base of the teeth. When the cement and mixture thus applied become thoroughly dry, the work so united is put into a furnace, sufficiently heated to fuse the cement, and immediately after the fusion thereof it is withdrawn from the furnace and cooled slowly.

The plaster mixture is then removed, and a gum color applied. The work is again placed in the furnace, as before, and, when fused, is withdrawn and cooled, as before, by which means the metallic back plates, solder, and blow-pipe are dispensed with, although back plates may be attached to the teeth if desired. Finally,

What I claim as my invention, and desire to secure by letters

patent, is a new mode of setting mineral teeth on metallic plates, by means of a fusible silicious cement, which forms an artificial gum, and which also unites single teeth to each other and to the plates upon which they are set.

Record, p. 426.

The evidence of Dr. Allen as to his method of making the porcelain plates is found on pp. 233–238. He says, p. 234:

"*Q.* 10. How long has this work been designated and known as continuous gum work?

"*A.* Over twenty years."

(He was examined in April, 1876.)

"*Q.* 11. Is there still any demand for these continuous gum teeth?

"*A.* Yes, sir; the demand is increasing constantly; it has maintained its integrity beyond all question.

"*Q.* 12. To what extent have you supplied sets of continuous gum work to your patients?

"*A.* I don't know as I can answer exactly, but it would number many thousands of sets, several thousands at least."

Defendant's Exhibit No. 28.

* * * * * * * *

This patent and this practice must be recognized as establishing another advance in the art, which has accrued to the public by lapse of time, and must be excluded from the claim of any subsequent inventor. A claim which would comprise the moulding around the teeth of any compound which was afterwards hardened by heat would include Allen's plates.

THIRD.

Plastic Materials or Substances moulded into Dental Plates.

GUTTA-PERCHA.

Truman's English Patent of 1848 is simply referred to as showing a described use of this substance for artificial dentures, which must be excluded from the Cummings claim.

Record, pp. 471, 474.

The use of gutta-percha is also described in a publication of 1851.

Mons. Delabarre, Jr., submits to the judgment of the Academy an article on the Employment of Gutta-Percha in the Manufacture of Sets of Artificial Teeth:

"In sets of artificial teeth, the part which represents the alveolar arch can be made of very different substances, but of which none are exempt from inconveniences. If one has recourse to metal, the whole apparatus is heavy, and it is only after repeated attempts that one can give to it the form which accommodates itself well to the irregularities of the edge of the gum in a manner to exercise an equal pressure on all parts.

"If one employs pastes, more or less analogous to porcelain paste, one has less difficulty, it is true, with respect to the modeling of the surfaces destined to be put in contact with the gums, but there remains the inconvenience of weight, to which may be added that of bulk, since, with very slight parts, the apparatus would lack the necessary solidity.

"Has one recourse to substances borrowed from the animal kingdom, such as ivory, the teeth of the hippopotamus, the tusks of the morse, one can have apparatus light without being fragile; but the work of modeling still remains difficult, and, what is a much greater inconvenience, the substances are attacked by the saliva or by the liquids which pass through the mouth; their surface, at the end of some time, becomes rough, and irritates the edge of the gums; they take, also, in spite of all cares of cleanliness, a displeasing odor, which they communicate to the breath.

"Gutta-percha is exempt from this fault, and the experiments to which one has submitted it show that, after a sufficiently long immersion in liquids more active than those with which it can find itself momentarily in contact in the mouth, it has experienced no alteration. Warmed in a wet-bath to a temperature of 100 degrees, it becomes soft enough to give the exact counter-proof of a kind of matrice in which one has made it enter by means of a pressure suitably exercised. This matrice, which is obtained by means of a double casting in plaster, represents very exactly the alveolar edge. One fixes in the arch thus

prepared, and by means of staples applied hot, either natural teeth or porcelain teeth. Let us add that the gutta-percha before being moulded, and while it is still in a state of softness, has been colored in a manner to imitate the tint of the gums, and that this color is durable."

Record, pp. 561–62.

At this stage of the art, then, we have these three classes of materials with their three modes of treatment: the metal moulded and hardened by cooling; the gutta-percha moulded and resuming its normal stiffness; and the paste composition moulded in its plastic state and then vitrified by heat. Each of these plates had tight joints, some closer than others; the tin and gutta-percha were cheap, the continuous gum was expensive, and there were objections to one or the other on these and perhaps on other grounds; but each comprised in degree the peculiarities of the Cummings plate in that the material composing the plate was in each packed around the teeth so that the teeth were firmly imbedded in the material, which was formed in one piece.

THE CUMMINGS PLATE OF VULCANITE WAS THEREFORE ONLY A SPECIES OF AN EXISTING GENUS, AND IS VOID OF NOVELTY UNLESS IT BE RESTRICTED TO THE DESCRIBED PRODUCT OF THE DESCRIBED PROCESS.

THE TRUE CONSTRUCTION OF THE CUMMINGS PATENT, RESTRICTING IT TO A VULCANITE PRODUCT, MADE FROM A VULCANIZABLE COMPOUND BY A VULCANIZING PROCESS, IS RES ADJUDICATA, AND WAS SO REGARDED BY THE COURT BELOW.

Judge Shepley says:

"The patent and its reissues granted for the invention of "John A. Cummings, of 'an improvement in artificial gums "'and palates,' or, as described in the claim, 'the plate of hard "'rubber or its equivalent for holding artificial teeth, or teeth "'or gums, substantially as described,' have been the subject of "extensive and prolonged litigation.

"Since the affirmance by the Supreme Court of the United

"States in Smith, Appellant, *vs.* Goodyear Dental Vulcanite "Company (3 Otto, 486) of the decree of the Circuit Court "in the test case of Goodyear Dental Vulcanite Company *vs.* "Smith, the validity of the reissued patent has been fully "established.

"*The decision of the Supreme Court in that case must be con-* "*sidered as final, not only as to the validity, but as to the con-* "*struction, of the patent,* which was carefully considered in that "case both in the Circuit and the Appellate Court, as it had "previously been in the Wetherbee and the Gardner cases.

"In Vulcanite Company *vs.* Smith, in the First Circuit, this "court decided that the patent was not for a process or art, but "for the new product resulting from the manipulation by the "described new process, and for one of those products in "which the process so adheres that the described product can "only be made by the described process, and that the inven- "tion was one in which the process by which it was made is a "part of the substance, the thing made, the manufacture. What "the new product was and wherein the novelty consisted in "the process, we shall hereafter have occasion to consider.

"In the opinion (by Mr. Justice Strong) in the Supreme "Court in the same case, the invention patented is thus de- "scribed: 'The invention, then, is a product or manufacture "'made in a defined manner. It is not a product alone sepa- "'rated from the process by which it is created. The claim "'refers in terms to the antecedent description, without which "'it cannot be understood. The process detailed is thereby "'made as much a part of the invention as are the materials of "'which the product is composed.'"

Record, pp. 583, 584.

Again Judge Shepley says:

"It will thus be seen that an essential element of the de- "scribed product is 'a plate of hard rubber or vulcanite,' in "which the teeth are imbedded, and an essential ingredient "in the described process is the soft rubber or gum, com- "pounded with sulphur, rubber, etc., in the manner pre- "scribed in the patent of Nelson Goodyear, for making

"hard rubber, and that an essential step in the described "process is the subjecting the compound of soft rubber "or gum with sulphur 'to sufficient heat to vulcanize or "'harden it, substantially as described in that patent' (*i.e.*, "the patent of Nelson Goodyear of May 6, A.D. 1851.

"The equivalent of that product thus made by that pro- "cess must therefore contain the equivalent of the plate of "hard rubber made and manipulated by a process equiva- "lent to the described process of compounding a gum with "sulphur and applying it and moulding it and incorporating "it with the teeth and gums, when in a soft state, and then "subjecting it to heat, to harden and vulcanize it in the "manner described in the Goodyear patent, or in some "equivalent manner, or by some equivalent process."

Record, p. 585.

That this holding was correct is shown by the detailed examination of the cases considered at pp. 26–35 of printed argument for Appellee.

SECOND.

CELLULOID IS NOT A VULCANIZABLE COMPOUND; CONTAINS NEITHER RUBBER NOR SULPHUR, NOR ANY EQUIVALENT FOR EITHER OF THOSE INDISPENSABLE INGREDIENTS OF THE CUMMINGS COMPOUND, AND IS NOT AN EQUIVALENT OF HARD RUBBER OR VULCANITE.

Upon the evidence in the case the court below found as follows:

"The defendants use, in making their set of artificial teeth, "a plate made of 'celluloid,' substantially a new material, "discovered and patented since the date of the Cummings "invention. This substance is compounded of cellulose or "vegetable fibre and camphor. No rubber or other equiv- "alent gum, and no sulphur or equivalent for sulphur in the "process, enter into its ingredients. It is not a vulcanizable "compound, and contains no vulcanizing agents in its com- "position. The camphor in its composition, instead of being "a vulcanizing agent, causes the composition to soften instead

"of harden under the influence of heat. The product, when "compounded, and before being subjected to heat, is not soft, "like soft rubber under like conditions, but hard.

"In the manipulation of this material, the process of "making a set of teeth, composed of the plate and teeth "and gums, is an entirely different process from the process "described in the Cummings patent, when compared with "that part of the Cummings process which was new in the "state of art, and the novelty of which part gave to the "Cummings process, when considered as a whole, the in-"gredient of novelty and patentability. It is not placed in "the mould in a soft, plastic condition, 'a little at a time, "'pressed in with the finger, or in any other convenient way,' "but in a hard, rigid condition, like horn or bone or ivory. "It is then subjected to heat, not to vulcanize or harden, but "to soften it. It afterwards, on being cooled or restored to "its original temperature, returns to its original condition as "a hard substance, as when first placed in the mould. No "vulcanizing process, or even process of hardening by heat, "and no equivalent for any such process, is practised. In the "light of these comparisons, it appears evident to the court "that the use of celluloid in the manufacture of sets of arti-"ficial teeth, as practised by the defendants, and the manu-"ture itself, the set or plate of teeth, differ as much, both as "to process and product, from the process and product de-"scribed and claimed in the Cummings patent, as that pro-"cess and that product differed from those previous manufac-"tures which existed before the Cummings invention, and "were unsuccessfully relied upon as anticipating it."

Record, p. 585.

WHAT CELLULOID IS, AND HOW IT IS MADE, AND WHEREIN IT DIFFERS FROM VULCANITE.

I. SMITH HYATT (called by defendant), one of the inventors and patentees of celluloid.

Record, pp. 222, 223.

Celluloid is a compound of vegetable fibre and gum camphor, with coloring matter in some cases.

The materials of which it is made are shown by
Deft.'s Exhibit 14, the paper.
Deft.'s Exhibit 15, the paper converted by acids and ground into a pulp.
Deft.'s Exhibit 16, the comminuted gum camphor.
Deft.'s Exhibit 17, the mixture of soluble paper-pulp, comminuted camphor, and a small proportion of oxide of zinc and of vermillion as coloring matter.
Deft.'s Exhibit 18, the piece of celluloid from which the dental plate blank is formed or shaped by being moulded in heated dies.
Deft.'s Exhibit 19, the celluloid dental plate blank for an upper set.
Deft.'s Exhibit 20, the celluloid dental plate blank for a lower set.
Deft.'s Exhibit 21, the celluloid dental plate blank for a partial set.

Celluloid does not contain any rubber, caoutchouc, gutta-percha, or other allied gum, nor any sulphur.

A suitable degree of heat softens the celluloid dental plate blank, the condition or character of which is precisely the same when allowed to cool after being softened by heat as it was before being softened.

The effect of vulcanization upon a vulcanizable compound is to change the mixture to a hard substance designated as hard rubber or vulcanite, a hard, brittle material, which may be softened a little by heat, but not sufficiently to allow it to be moulded into the forms of sets of artificial teeth, in which respects it differs from celluloid, which is a hard and tough material, which may be readily softened by heat and moulded into the form of a set of artificial teeth, or in any other desired form. In general terms, hard rubber cannot be remoulded for the purposes of dentistry, while celluloid can.

Celluloid cannot be packed into the mould a little at a time and moulded into the dental plate, because it cannot be sufficiently softened under a heat that would allow it to be handled,

it requiring a very heavy degree of pressure under a high degree of heat.

If pieces were put in they would not unite or weld together to form a homogeneous mass.

Cross-Examined. Record, p. 224.

× *Q.* 24. Have you ever had any practical experience as a manufacturer of vulcanized rubber; if so, where and when?

A. I never manufactured any vulcanized rubber.

× *Q.* 25. Have you any knowledge of the properties and qualities of vulcanite or hard rubber in the process of its manufacture, except what some one has told you; if so, where and when did you acquire that knowledge?

A. The only knowledge I have as to the manufacture of hard rubber is what I have acquired from reading, conversing with others, seeing dentists make vulcanite sets of teeth, and having been, on two or three occasions, for very short times in three rubber factories; one a factory at Newark for making overshoes, another a factory at Newark for making rubber-coated harness trimmings, and another a factory at New Brunswick for making buttons and other articles.

× *Q.* 26. In the course of your reading where did you find it written or printed that "hard rubber" is a hard brittle material?

A. I don't remember to have ever read that description of it —don't remember whether I have or not.

× *Q.* 27. Who told you then that "hard rubber" is a hard brittle material?

A. I have frequently heard dentists call it brittle.

× *Q.* 28. Who is the dentist that told you that "hard rubber is a hard brittle material," and when did he tell you that, and who was present when he communicated that information?

A. I don't remember any particular dentist; I know, however, that with those dentists with whom I have had conversations on the subject of rubber, they generally call it brittle or liable to be easily broken; and I know it better by my own experience in hard rubber by breaking it in my hands; from dropping hard rubber combs to the floor and their breaking,

and from hearing dentists say that if a set of hard rubber teeth were allowed to fall on the floor, there would be danger of its breaking.

Complt.'s Exhibit "Bacon No. 2" is a piece of the vulcanizable compound of sulphur and rubber.

Record, p. 49.

Compare this Exhibit with Defendant's Exhibits 18, 19, 20, and 21.

The details of the process of compounding rubber and sulphur and converting it into vulcanite have already been quoted from the Goodyear Patent of 1851.

For the details of the process of compounding the converted paper-pulp (nitro-cellulose) and the camphor, and converting this compound into celluloid, reference is made to the Hyatt Patent of July 12th, 1870, reissued June 3d, 1874.

Record, pp. 250, 252.

And for the details of the process of forming or shaping the celluloid into dental plate blanks (such as Defendant's Exhibits 18, 19, 20, and 21), reference is made to the Hyatt and Perkins Patent of March 28th, 1871.

Record, pp. 247, 249.

Touching these facts there is no controversy or question, and it is respectfully submitted that there was no error in the finding of the court below, that celluloid is not an equivalent of hard rubber or vulcanite in the sense of the Cummings patent, nor in contemplation of law.

To make celluloid the vegetable fibre (Defendant's Exhibit 14) is subjected to the action of acids, which convert it into nitro-cellulose; this nitro-cellulose is ground into a pulp (Defendant's Exhibit 15) and mechanically mixed with ground camphor (Defendant's Exhibit 16) and coloring matter; and this mixture (Defendant's Exhibit 17), being subjected to heat and pressure, becomes celluloid.

A piece of celluloid (Defendant's Exhibit 18) is again subjected to heat and pressure in moulds or dies, which shape it into the dental plate blank (Defendant's Exhibits 19, 20, 21), in which form it is put upon the market and sold to dentists.

In its adaptability to use for making a set of artificial teeth, celluloid is a hard material which simply undergoes the ordinary change of melting by heat and returning to its original condition when cold, like rubber or gutta-percha, or metals.

Vulcanite is a hard product obtained from the treatment of a compound by heat, which creates a material non-existent at the commencement of the process, like porcelain or other vitrifiable substances.

HOW A SET OF ARTIFICIAL TEETH IS MADE UPON THE CELLULOID BASE, AND WHEREIN THAT PROCESS DIFFERS FROM THE PROCESS OF MAKING A SET OF ARTIFICIAL TEETH UPON A RUBBER BASE.

An impression of the mouth is taken, and from that a mould is made in the same way as in making a vulcanite plate, and as described by Hawes in 1850.

Record, pp. 918, 919.

Wildman, Record, pp. 345, 346.

A celluloid dental plate blank (such as Defendant's Exhibits 19, 20, 21) is then selected; it must be of sufficient size not only to fill the mould but to overflow in all directions, in order to secure the back or lateral pressure from the mould that the adaptation of the celluloid may be perfect, and the pressure uniform and thorough in all parts (p. 42). The mould with the blank interposed between its two halves is then placed in a flask, and this flask is put in the heating apparatus, which has a screw-plunger for forcing the two parts of the flask together gradually (p. 43). After the temperature in the heater has been raised to about 270° Fahrenheit, the plunger is turned so as to apply pressure gradually until the flask is completely closed. As soon as the flask is closed the heating flame is extinguished and the apparatus allowed to cool (p. 44).

This is the steam-heating process; but the plate may also be moulded in oil (p. 45, and p. 248), the temperature in such cases being raised to 300° or 310°.

From 20 to 40 minutes is all the time the celluloid requires to be subjected to heat.

Colburn, p. 229.

I. Smith Hyatt.

Q. 16. Are you familiar with the process of making a set of teeth on a base of hard rubber or vulcanite, and with the process of making a set of teeth on a base of celluloid?

A. I am.

Q. 17. In what respect do said processes differ from one another, if at all?

A. In both cases a plaster mould is made, modelled to the required shape to fit the mouth, with the teeth arranged in the moulds in proper position.

In the case of rubber the flask containing the mould and teeth is heated; soft or mixed rubber taken, also heated to make it soft, and a suitable amount pressed into the mould with the fingers; after a sufficient amount has so been pressed into the mould to fill the space between the two halves of the flask, the other half of the flask is pressed and clamped together with its counterpart, so that the soft rubber completely fills the space in the mould.

In the case of celluloid, a celluloid blank similar to Exhibits 19, 20, or 21 is placed into the part of the flask containing the teeth, and the other part of the flask placed upon it; the two parts of the flask are held apart by the celluloid dental plate blank at this stage; now the flask and contents are placed into a heating and pressing apparatus, and heat applied sufficient to soften the celluloid blank; pressure is then applied by means of a screw and the two parts of the flask gradually forced together, moulding the celluloid blank into the exact shape of the mould, filling it in all parts; as soon as the flask is together it is cooled off, the moulded plate removed from the flask and finished.

In the case of the rubber, after the flask has been brought

together, containing the mixed unvulcanized rubber, it is put into a vessel containing water, closed tight, and heated up to about 320 degrees, and kept at that degree of heat for from an hour and a quarter or thereabouts, and upwards; after it has been subjected to this 320 degrees of heat for about an hour and a quarter, it is cooled off, taken out of the flask, and the mixed rubber that was is found to be transformed by the action of heat into hard rubber or vulcanite properly shaped for a set of artificial teeth; it is then finished.

Q. 18. How long does it require to complete the celluloid plate, from the time it is put into the heating and pressing apparatus?

A. Generally about twenty-five minutes is required from the commencement to the completion of the moulding.

Q. 19. Can celluloid be packed into the mould a little at a time, and moulded into the dental plate; if not, why not?

A. It can't be sufficiently softened under a heat that would allow it to be handled; it requiring a very heavy degree of pressure under a higher degree of heat; if pieces were put in they would not unite or weld together to form a homogeneous mass.

Record, p. 223.

A celluloid blank while being moulded is in a mould which is only closed as the moulding process advances, while the rubber compound is packed into the mould, and the mould is closed before the application of the vulcanizing heat begins.

With the rubber compound the packed mould is closed and clamped together before being placed in the heating apparatus, while with celluloid the blank is put between the two halves of the mould and the mould put under the screw-plunger, and as the blank softens the screw is turned to gradually force the mould together, and when the mould is thus closed the process is completed. In other words, there is no further application or continuance of heat necessary for the purpose of changing or converting the material in any respect.

The celluloid plate is packed, moulded, and completed in the heater in closing the mould. The rubber plate, when the

mould is closed, is only ready to be placed in the heater to be converted into vulcanite by the vulcanizing process. When the mould is closed with the rubber, the article of manufacture is not complete, nor can it be completed except by gradually raising the temperature of the vulcanizer first to 212°, then to 260°, then 310°, and keeping it at the temperature thus slowly attained for about an hour and ten minutes (Nute, p. 191). When you get a rubber plate up to 260° in twenty or thirty minutes, in thirty or forty minutes more you can bring it to 310°, and there you must keep it for an hour and a quarter. So the vulcanite plate process is first packing the plastic material into the mould and moulding the plate (that is, assuming that in both cases the user buys the material in the market—both known articles of trade in the market—and in both cases having the mould in which the teeth are imbedded in plaster in the same way); second, closing the mould and clamping it or locking it; third, subjecting the packed mould to the vulcanizing process in the heater; there the vulcanizing process ends. With the rubber, again the vulcanizing process is made up of various steps or stages: First, moulding the vulcanizable compound; second, putting the closed mould into the vulcanizer; third, raising the temperature to the vulcanizing point, not too rapidly, but gently, occupying an hour and a half; fourth, continuing to subject it to that temperature for not less than fifty minutes with some kinds of rubber, and generally for from one hour and ten minutes to one hour and fifteen minutes. The mould must be closed before the heat is raised to the vulcanizing point (Nute, p. 199, A. 124).

So we have instead of one simple process, as with celluloid, two separate processes,—moulding and vulcanization,—and even the process of moulding the celluloid plate is essentially different from the process of moulding the rubber plate.

The celluloid plate may be left in the heater to cool down, or it may be taken out and cooled as soon as the mould is closed, but the rubber plate will be underdone if not left in long enough to vulcanize it properly, and overdone if left in longer than is necessary to vulcanize it properly. So while in any case the celluloid plate is ready to be removed as soon as

the mould is shut, because the process is completed, the rubber plate is to be carefully watched and duly attended to until properly vulcanized (Nute, p. 191).

We have the positive testimony of Josiah Bacon that (up to December, 1873) there is no known way of making the vulcanite plate except that described in the Cummings Reissue 1904.

Record, pp. 137, 138.

Cross-Int. 31. Can you tell, from seeing a hard rubber dental plate, how it was made?

Ans. When I see a rubber denture I presume it was made in accordance with Reissue No. 1904, as I believe there to be no other known method of making a rubber vulcanite plate.

Cross-Int. 39. Then do you consider that a plate of hard rubber or vulcanite for holding artificial teeth, or teeth and gums, however made, an infringement of the Cummings Patent 1904?

Ans. From my position as manager of this company, and my constant intercourse with the dental profession, it could not fail to come to my knowledge were any other method of making a dental plate of vulcanite known; and none other method than that described in Reissue 1904 *has ever been made known to me.*

We have already quoted Judge Shepley's summary of this process.

Supra, pp. 14, 15.

See testimony of H. B. Renwick, quoted at pp. 23, 26, of Printed Argument for Appellee.

The rubber compound, in a soft, putty-like condition, is packed into the Hawes mould (H. B. Renwick, Record, p. 59, × Q. 28) so as to form the plate; the mould is then closed and the two parts clamped together, and the packed mould, thus closed and clamped, is put into the heater without the application of any pressure and subjected to the vulcanizing process. Except by regulating the heat and determining its continuance, the operator cannot in any way aid or control the vulcanization which is proceeding in the closed mould. No application of pressure is possible in the closed mould.

This rubber plate process, then, differs from the tin base process only in the fact that the mould is packed with rubber before it is closed, while the tin was poured into the closed mould, and the compound of rubber is vulcanized in the closed mould, while the tin simply cooled down in the closed mould.

On the other hand, the celluloid process differs from the rubber process in that the two halves of the mould are kept apart by the hard dental plate blank; simply resting on the lower half and supporting the upper half; the mould thus partially closed is put into the steam-heater or into the tank of oil, and pressure is immediately applied for the essential purpose of not only keeping the blank in place, but to do what in the rubber plate is done with the fingers; as the heat is raised the pressure is increased, so as gradually to force the celluloid into the mould and around the teeth and pins; this pressure being derived not only from the screw-plunger bearing upon the mould, but also being exerted by the surplus of celluloid provided for this express function in the dental plate blank, which surplus exudes between the two halves of the mould as they are gradually forced together. Under this combination of vertical and lateral pressures the plate is moulded as the mould is closed, and the entire operation is completed with the completion of the moulding process.

Without this pressure the celluloid blank would not soften under the heat employed sufficiently to mould itself around the teeth and pins, and the celluloid moulding apparatus is provided with means for applying such pressure vertically, while the lateral pressure is ensured by the surplus material put in the blank for that especial object (Record, p. 42). The celluloid process therefore depends absolutely upon the pressure in conjunction with the heat.

Volney D. Nute, appellant's witness, says:

Cross-Int. 62. You say that you have used a glycerine apparatus, but not for rubber. What did you make in the glycerine apparatus.

Ans. Sets of teeth on celluloid blanks.

Cross-Int. 63. You say you never used a steam apparatus at

all prior to this one you procured on the 24th of August last; in fact, you never knew anything of the working of it up to that time. Isn't there some mistake about that answer?

(*Question and Answer* 6 *read to witness.*)

Ans. No; I never did know anything about a steam apparatus up to that time, the 24th of August last.

Cross-Int. 64. How have you been vulcanizing rubber sets of teeth at Flagg & Osgood's for the past 13 years?

Ans. By the Hayes vulcanizer, by the process before described for vulcanizing rubber.

Cross-Int. 65. Then you have been using a steam apparatus for vulcanizing rubber thirteen years, have you?

Ans. Yes.

Cross-Int. 66. In what particular does this apparatus, which you have been using for 13 years, differ from the celluloid steam apparatus which you procured on the 24th of August last?

Ans. This celluloid moulding apparatus has a screw-plunger going through the top, for forcing the flask or moulds together; the vulcanizer which I have used for the past 13 years is the same, with the exception of the screw-plunger. I have not used the plunger, having brought the flasks or moulds together with a screw-clamp like Exhibit Nute No. 4, before putting into the vulcanizer which I now use, and have used for 13 years.

Cross-Int. 67. In vulcanizing rubber, then, you have clamped and screwed the flasks together, and simply set it in the vulcanizer, and closed the vulcanizer without having any pressure upon the flask except the screw-pressure?

Ans. Yes; I had a pressure on the flask to keep it together while in the vulcanizer. After clamping it together, I held it there by three screw-bolts, and then it was put into the vulcanizer under the pressure of those three screw-bolts.

Cross-Int. 68. But you had no pressure upon the flask, except these clamping screw-bolts which kept the two parts together?

Ans. None other.

Cross-Int. 69. Did you ever make a set of teeth on a celluloid base by packing and clamping together the flask, and putting it into the vulcanizer without any pressure except that of the screw-bolts as last mentioned?

Ans. No, sir; for there is no occasion for it, the celluloid base being hard, and not requiring vulcanizing the same as rubber.

Cross-Int. 70. Did you ever vulcanize a rubber set in a glycerine apparatus, or an oil apparatus?

Ans. No, sir; I did not.

Cross-Int. 71. Do you know if you could get the two parts of the flasks together with a celluloid blank in the flask, without a plunger, or similar pressure?

Ans. No, sir; you could not, without using a plunger or a screw-clamp.

Record, pp. 193, 194.

In Burr *vs.* Duryee, 1 Wall., 575, 576, Mr. Justice Grier, delivering the opinion of this court, adverts to the practice of reissuing patents that have been judicially pronounced valid, in order to make a claim so elastic that it may include all previous or future inventions for the same purpose.

The appellant has observed the warnings given in that opinion, and has not attempted to reissue his reissue, but now asks the court to expand his claim by a new construction, which would be inconsistent with its prior adjudication.

This court has very clearly defined its position upon the construction of claims. "As patents are procured *ex parte*, the "public is not bound by them, but the patentees are. And the "latter cannot show that their invention is broader than the "terms of their claim; or, if broader, they must be held to "have surrendered the surplus to the public."

Keystone Bridge Co. *vs.* Phœnix Iron Co., 95 U. S., 279.

Railway Co. *vs.* Sayles, 97 U. S., 563, 564.

Merrill *vs.* Yeomans, 94 U. S., 586.

In view of the contests in the Patent Office over Cummings' applications, there is a special applicability in the latest reported reiteration of this rule by this court.

"It is well known that the terms of the claim in letters "patent are carefully scrutinized in the Patent Office. Over "this part of the specification the chief contest generally arises. "It defines what the Office, after a full examination of previous

"inventions and the state of the art, determines the applicant "is entitled to. The courts, therefore, should be careful not to "enlarge by construction the claim which the Patent Office "has admitted and which the patentee has acquiesced in, "beyond the fair interpretation of its terms."

Burns *vs.* Meyer, 100 U. S., 672.

The history of the proceedings at the Patent Office in Cummings' case are discussed at pages 7–16 of the Printed Argument for Appellee.

We submit that not only is the true construction of the claim settled beyond question, but that it cannot be varied so as to meet Mr. Bacon's assumption, nor upon Mr. Renwick's postulates, and that there was no error in the finding of the court below as to the essential elements of the patented process and product.

WITH SUCH MARKED DIFFERENCES AS THESE IN THE MATERIAL EMPLOYED, IN THE APPARATUS REQUISITE FOR TREATING THE MATERIAL, AND IN THE PROCESS OF THE TREATMENT, IT IS RESPECTFULLY SUBMITTED THAT THE COURT BELOW WAS NOT IN ERROR WHEN IT RECOGNIZED THE CELLULOID SET OF ARTIFICIAL TEETH AS A SUBSTANTIALLY DIFFERENT PRODUCT OF A SUBSTANTIALLY DIFFERENT PROCESS FROM THE PRODUCT AND THE PROCESS CLAIMED IN THE CUMMINGS PATENT, AND HELD IT TO BE AN INDEPENDENT INVENTION.

THIRD.

"CELLULOID" IS A SUBSTANTIALLY NEW MATERIAL DISCOVERED AND PATENTED SINCE THE DATE OF CUMMINGS' INVENTION AND SINCE THE DATE OF HIS PATENT (1864), AND CANNOT THEREFORE BE COMPRISED AMONGST INFRINGING EQUIVALENTS OF HARD RUBBER OR VULCANITE.

To prove the alleged infringement, complainants called Mr. H. B. Renwick, p. 53.

Ques. 4. Have you read and do you understand Complain-

ants' Exhibit Hyatt No. 2,* and the manufacture described therein; and also Letters Patent of the United States granted to I. Smith Hyatt and others, assignors to the Albany Dental Plate Company, dated March 28, 1871, No. 113,055,† and the manufacture described therein; and also Letters Patent of the United States No. 121,522,‡ dated December 5, 1871; and the Letters Patent of the United States No. 152,232,§ dated June 23, 1874, and the process and mechanism described in said last two mentioned letters patent; assuming that the apparatus described in Patent No. 152,232 is used for moulding the plate and causing the union between the plate and the teeth, as described in said Letters Patent No. 113,055; and state whether the manufacture described in said Exhibit Hyatt No. 2, or in said Letters Patent No. 113,055, when the teeth are united to the plate, by the method of causing the union between the plate and the teeth, described in said several letters patent, or either of them, resembles or differs from the thing embraced in Cummings' Reissue No. 1904; and examine also Complainants' Exhibit Hyatt No. 3, and Complainants' Exhibit Hyatt No. 4, and compare them with what is embraced in said Reissue No. 1904?

Ans. I understand that the sets of teeth Hyatt No. 3 and Hyatt No. 4 are made of a kind of solid collodion now called celluloid, and mineral teeth, and that they are made in either one or the other of the apparatus described in Letters Patent 152,232, or Letters Patent No. 121,522, substantially in the manner and of the materials which are described in the Patent 113,055. I have read all the patents and the circular referred to in the question, and believe that I understand them.

The Patent No. 113,055 refers, for the particulars of the manufacture of the kind of solid collodion from which the dental plate blank is made, to the Hyatt Patent of July 12th, 1870 (Record, pp. 103, 104), though not giving the correct number of it, and Mr. Renwick understands that the celluloid plate is made from a blank, such as Fisk Celluloid Exhibit (p. 85).

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* Record, pp. 38, 45.
† Record, pp. 247, 249.
‡ Record, pp. 105, 106.
§ Record, pp. 107, 109.

Upon these premises Mr. Renwick bases his comparison of the celluloid dental plate with the Cummings patent, and finds an infringement,—"The celluloid dental plate, made as referred to in the question, is, in my opinion, substantially the article of manufacture described and claimed in the Cummings reissue" (p. 53). . . . And he continues (p. 54):

"I am of the opinion, previously expressed as to the substantial identity of the two articles, although I know that celluloid is a different chemical compound from vulcanite, because I believe that the substantial resemblance must be sought in those points or characteristics which are brought into play in actual use, and not in characteristics which are unimportant in such use. *In further support of this opinion, I state that solid collodion was described before the date of the Cummings reissue* as a substance which might be used in many manufactures where vulcanite had been used, and that I have seen it myself (although I cannot state that it was before the date of the Cummings patent) used for knife-handles and cheap jewelry, as vulcanite was and is used. I further state that solid collodion, prior to the date of the Cummings patent, was obtained by evaporating out the solvent, and that such solvents were liquid solvents, such as ether; and that I have examined patents dated before the date of the Cummings patent which describe the mixture of camphor and other gums with collodion.*

"*Ques.* 5. Do you understand that celluloid is compounded with sulphur, rubber, etc., in the way sulphur and rubber are usually compounded, or is subjected to heat to harden it?

"*Ans.* I do not understand that celluloid is compounded with sulphur, or has any sulphur in it; I understand that celluloid is subjected to heat while in moulds to soften it, and make it fit the teeth perfectly by pressure, as the vulcanizable compound is, and that celluloid is hard when cold, hardening during the cooling. A vulcanizable compound becomes of a tarry consistency while subjected to

* For "reissue" substitute "original patent." Record, p. 60.

"heat in the mould, and is hard when cold, after being sub-
"jected to the heat, but I do not know when it commences
"to harden, whether during the cooling or while at the
"highest heat; although I do know that the final hardening
"takes place during the cooling."

Cross-examined. P. 60.

Cross-Ques. 32. You have referred to solid collodion as described before the date of the Cummings reissue as a substance which might be used where vulcanite had been used, and that you had seen it yourself (although you could not state that it was before the date of the Cummings patent) used for knife-handles and for cheap jewelry, as vulcanite is used; how was this solid collodion manipulated in forming it into the articles you have mentioned?

Ans. I do not know how it was manipulated in order to form the articles I saw.

Cross-Ques. 33. What were the liquid solvents in those collodions, if any, other than ether?

Ans. I don't remember any other than ether, although the patents or publications may describe some other.

It is to be observed that neither here nor in any other part of his deposition does Mr. Renwick make any comparison between Hyatt's celluloid and the older forms of collodion, nor does he even intimate an opinion that the older forms of solid collodion, to which he refers, are substantially the same as the Hyatt celluloid.

No other mention is made of previous forms of solid collodion except that contained in three patents put in evidence by complainant and one by defendant, in each of which collodion is described.

Taking these in the order of their respective dates, we have

1st. Cutting's English Patent, 1854. Record, pp. 205, 208.

"This invention consists in an improved process of taking
"photographic pictures upon glass, and also of beautifying and
"preserving the same, which process I have styled 'ambro-
"type.' My improved process has reference to the art of
"taking pictures photographically on a film of collodion upon

"the surface of a sheet of glass, the collodion being suitably "prepared for the purpose."

He then describes his use of alcohol for depriving the gun-cotton, of which the collodion is made, of its aqueous ~~investure~~ moisture. From this alcohol it is taken immediately to the mixture in which it is to be dissolved for the purpose of forming the collodion. This mixture consists of 10 parts of sulphuric ether and 6 of alcohol, or thereabouts. The collodion thus formed is allowed to remain until it has settled perfectly clear, which usually requires about 24 hours. It is then decanted, and to every pint is added 80 grains of iodide of potassium dissolved in alcohol. It is then well shaken, and 32 grains of refined gum camphor is added to each pint of the collodion, and after it has again settled it is fit for use. The object of the camphor is to increase the vigor and distinctiveness of delineation of the positive picture, and particularly of the half-tints. It also greatly increases the beauty of the picture, by giving a fineness of deposit not heretofore attained by any other means.

The collodion is then applied to the surface of the glass in the following manner:

"The plate of glass being held horizontally, a portion of the "collodion is poured upon it, and it is then inclined in different "directions, *so as to cause the collodion to flow over its whole sur-"face, upon which it forms a colorless transparent film;* the ex-"cess of collodion is then allowed to *run* off, and the glass being "still held horizontally is inclined to one side and the other, "until the collodion becomes partially *thickened or set.* When "this has taken place, and before it is dry, it is *rinsed in a solu-"tion of crystalized nitrate of silver*, of a strength of forty grains "to the ounce of water; the *film* is thus impregnated in the "iodide of silver, and after remaining in this bath a sufficient "length of time for the ether to escape from the collodion, the "plate is ready to be placed in the camera."

Record, p. 206.

No reference is made to this patent by any witness in this case, and it seems unnecessary to say more respecting it than

that so far from being celluloid, Cutting's collodion is not even a form of solid collodion at all.

2d. Parkes' Patent of 1855. Record, p. 210. Complainants' Exhibit P.

This patent describes a process for "water-proofing and "manufacturing various articles having properties analogous to "those made from india-rubber or gutta-percha, 'by treatment "'with solutions of gun-cotton or other similar compounds.'"

In the specification the patentee says, "It is well known that "a solution of gun-cotton has been used principally as a pho- "tographic agent and in surgical operations; my object is to "employ collodion or its compounds for manufacturing pur- "poses generally. *The method of dissolving gun-cotton being "well known, I do not think it necessary to give proportions*, but "simply say that when I use a thin solution I add more of "either of the solvents to the gun-cotton, and if I require a "stiff preparation, less of the solvent is to be used. I dissolve "gun-cotton or other similar compound in vegetable naphtha, "alcohol, methylated or other ethers, or other solvents of gun- "cotton."

The specification goes on: "When manufacturing sheets from "solutions or preparations of gun-cotton alone, or combined with "india-rubber, gutta-percha, or other substances, and whether "colored or not, I prefer to use a thick solution, and with "spreading machinery, similar to that used in the manufacture "of india-rubber, I spread the preparation in the well-known "manner until I obtain the desired thickness. *The solvent may "be recovered, if required, by condensing it as it passes off while "the sheets are drying at a temperature of from* 100° *to* 200° "*Fahrenheit.* These sheets may be transparent and colorless, "or they may be colored or combined with a variety of sub- "stances to produce different effects, suitable for book-binding, "button manufacture, and other applications where a hard, "strong, brilliant material is required; or flexible sheets may "be made by varying the proportions of the substances used. "Or I make sheets or other forms by using as little of the "solvent of gun-cotton as possible, so as to obtain a stiff plastic

"compound, which may be colored or combined with other "substances, and this I work up with any suitable machinery "until well blended or incorporated, when it may be rolled or "pressed into sheets or other forms; when dry it is very hard "and water-proof."

Record, p. 211.

No reference is made to this patent by any witness in this case, and it seems sufficient to say that it does not describe any use of camphor in compounding the collodion, nor does it describe solid collodion in the sense of the Hyatt patents. It certainly does not describe the Hyatt method of making celluloid, nor the product of that process.

3d. Barnewell & Rollason's Patent of 1860. Complainants' Exhibit Q. Record, pp. 212, 219.

This patent describes a process of mixing solutions of pyroxiline with animal, vegetable, and mineral substances, by which its quality is altered in such manner as to produce hard, resistent, adhesive, plastic, or resilient compounds.

"Our invention consists in dissolving pyroxiline in any of "its known solvents and adding thereto oils,—animal, vege-"table, or mineral,—varying in their nature and their action "with pyroxiline, selecting any of these to suit any particular "views we may entertain relative to the subsequent use of the "compound."

Of this long specification it is only necessary to further quote the following as to the mode of using the compound (p. 216):

"If in a plastic state, then it may be treated as a paste: if in "a fluid condition, it may be poured or brushed upon the mould, "or the mould may be immersed in it until by adding coat upon "coat sufficient thickness has been acquired, and as each coat "attains the desired condition, that is to say, dry or partially "so, according to circumstances, we can introduce a coat or "sheet of any material, to make up thickness and inflexibility, "such as varnish, starch, gelatine, afterwards proceeding to "apply thereupon an additional coat or coats of our compound;

of Hyatt's celluloid, of which the letters patent themselves are *prima facie* evidence, must be considered to be unshaken.

If, then, celluloid was not known prior to 1870, it cannot be comprised within the Cummings patent, no matter how wide the construction may be which is put upon that patent.

FOURTH.

A CELLULOID DENTAL PLATE CANNOT BE COMPREHENDED WITHIN ANY CONSTRUCTION THAT CAN BE PUT UPON THE CUMMINGS PATENT, BECAUSE CELLULOID WAS NOT KNOWN AT THE DATE OF THE CUMMINGS APPLICATION.

In May, 1852, Cummings filed a caveat in the Patent Office, in which he described his invention. His original application for a patent was made in April, 1855.

There is no evidence showing the existence of such a thing as solid collodion at the time when the caveat in which he describes his invention was filed.

The earliest mention of anything in the nature of solid collodion is in the Cutting patent, which was published in January, 1855 (Record, p. 205), and, it will be remembered, this patent only describes pouring liquid collodion over a plate of glass and allowing it to dry, so as to form a thin film on the surface of the glass for the purpose of taking ambrotypes.

Solid collodion was not known then, so far as the evidence in this case shows, when Cummings first described his invention and made application for a patent.

In describing his invention, both in his caveat and original specification, he declares it to consist "in forming the plate, and "also the gums in which the teeth are inserted, of rubber or "*some other elastic material.*"

If instead of using the words "*some other elastic material*" Dr. Cummings had specified everything which in the *then* state of the art could have been substituted for rubber, his specification would have been just as broad, and would not have named solid collodion, because it was not known at that time.

If solid collodion of a kind fitted for the making of a dental plate had been invented or discovered in the interval between

I. THAT, AS MATTER OF LAW, THE DEFENDANT, IN MAKING A DENTAL PLATE OF HYATT'S CELLULOID BY THE PROCESSES PATENTED TO HYATT IN 1871, HAS USED A MATERIAL KNOWN AS AN EQUIVALENT OF HARD RUBBER OR VULCANITE IN 1864, AND A PROCESS KNOWN IN 1864 AS AN EQUIVALENT OF THE VULCANIZING PROCESS.

II. THAT, AS MATTER OF LAW, THE HYATT CELLULOID AND THE HYATT PROCESSES, PATENTED IN 1870 AND 1871, WERE IN 1864 KNOWN EQUIVALENTS OF THE GOODYEAR VULCANIZABLE COMPOUND AND THE GOODYEAR VULCANIZING PROCESSES, AND THAT SUCH PRIOR KNOWN EQUIVALENTS ARE DESCRIBED AS SUCH IN THE CUTTING, PARKES, BARNWELL & ROLLASON, AND MACINTOSH PATENTS.

Of course, in the present proceeding the function of a jury is discharged by the court. The court, however, cannot, any more than the jury could, find that the thing denoted by the Hyatt specification as solid collodion is the same as the thing denoted by the specifications of the four several alleged anticipating patents in the entire absence of any evidence on the question.

This court has more than once had occasion to state that it is not its province to compare such documents as these patents and decide on the identity or the diversity of the inventions.

Bischoff *vs.* Wethered, 9 Wall., 813, 816.

And it has even said that *it has no right to decide that one patent covers the invention of another, or that it did not.*

Tucker *vs.* Spaulding, 13 Wall., 455, 456.

In the present case—for reasons no doubt deemed sufficient—the complainant did not call a single witness to say whether the thing denoted by any of the several specifications is the same as celluloid, and there is no such evidence in the record.

In view, then, of the difference apparent on the face of the specifications between old solid collodion and celluloid, coupled with the fact of the absence of any evidence to show that the things described in the specification are the same, the novelty

Furthermore, the letters patent granted for celluloid, and for its treatment, and for the apparatus with which it is treated, are *prima facie* evidence of the novelty of the material and the processes.

There is therefore not only no presumption of law that celluloid was known at or before 1864, the date of Cummings' patent, but there is a presumption to the contrary raised by the introduction of these Hyatt patents under the pleadings in this case, which throws upon the appellant the burden of proving the alleged equivalency of the material, and the fact of its known existence at the date of the Cummings patent.

The argument on this point might safely be allowed to rest here, but there is another reason, equally conclusive, why these four prior patents must be discarded as not containing a description of Hyatt's celluloid.

In comparing specifications, the first duty of the court is to determine the legal construction of each document. "But "after that duty is discharged there would remain a most im- "portant function to be still performed, which is the comparison "of the two instruments when they have received their legal "exposition and interpretation; and, as it is a matter of evi- "dence what external thing is indicated and denoted by any "description, when the *jury* have been informed of the mean- "ing of the description contained in each specification, the "work of comparing the two and ascertaining whether the "words (as interpreted by the court) contained in specification "(A) do or do not denote the same external matter as the "words (as interpreted and explained by the court) contained "in specification (B) is a matter of fact, and is, I conceive, a "matter within the province of the jury, and not within the "function of the court."

Hill *vs.* Evans, *ubi supra*, 295.

THE APPELLANT ASKS THE COURT TO SUPPLEMENT THE PROOF OF INFRINGEMENT IN THIS CASE BY COMPARING THESE FOUR PATENTS WITH THE HYATT PATENTS OF 1870 AND 1871, AND TO DECIDE, UPON SUCH COMPARISON,

"the use of mankind. It is the difference between the ore and "the refined and pure metal which is extracted from it.

"Again, it is not, in my opinion, true in these cases to say "that knowledge, and the means of obtaining knowledge, are "the same. There is a great difference between them. To "carry me to the place at which I wish to arrive is very differ- "ent from merely putting me on the road that leads to it. There "may be a latent truth in the words of a former writer, not "known even to the writer himself; and it would be unreason- "able to say that there is no merit in discovering it and unfold- "ing it to the world.

"Upon principle, therefore, I conclude that the prior knowl- "edge of an invention to avoid a patent must be knowledge "equal to that required to be given by a specification; namely, "such knowledge as will enable the public to perceive the "very discovery, and to carry the invention into practical use."

The knowledge that was essential to Hyatt's invention of celluloid was the knowledge that comminuted camphor remained inert when mechanically mixed with pyroxyline at ordinary temperature,—and yet became an active solvent of the pyroxyline when the mixture is subjected to heat above the ordinary temperature.

The discovery of this fact by Hyatt was the foundation of his invention. Where, in any prior publication, search them as you will, can you find even a hint of this fact?

"Whatever is essential to the invention must be read out of "the prior publication."

You may read and reread the specifications of these Cutting, Parkes, Barnwell & Rollason, and Macintosh patents, and you will nowhere find either the ingredients of celluloid as used by Hyatt, or the process of using them, or any product having the peculiar properties, and, for use in a dental plate, the absolutely essential property, which his product—celluloid—possesses.

The conclusion is therefore irresistible that "*such knowledge "as will enable the public to perceive the very discovery and carry "the invention into effect*" is found nowhere in these patents of Cutting, Parkes, Barnwell & Rollason, or Macintosh.

The Macintosh patent does not describe the compound of nitro-cellulose and camphor, which constitutes the subject-matter of the Hyatt Patent of July 12th, 1870, nor the method of producing that compound ~~over~~ nor the method of making the dental plate blank described in the Hyatt & Perkins Patent of March 28th, 1871; nor the method of making a set of teeth upon such a blank; nor the apparatus employed in moulding such sets of teeth, as patented to the Hyatts in December, 1871.

Neither celluloid nor the method of making and of using celluloid is to be found described in the Macintosh patent.

In Hill *vs.* Evans, 4 DeGex, Fisher and Jones, 300, Lord Westbury says:

"One of the means of imparting knowledge to the public is "the publication of a book, or the recording of a specification "of a patent. If, therefore, in disproving that allegation which "is involved in every patent, that the invention was not pre- "viously known, appeal be made to an antecedently published "book or specification, the question is, What is the nature and "extent of the information thus acquired, which is necessary "to disprove the novelty of the subsequent patent? There is "not, I think, any other general answer that can be given to "this question than this: that the information as to the alleged "invention given by the prior publication must, for the pur- "poses of practical utility, be equal to that given by the subse- "quent patent. The invention must be shown to have been be- "fore made known. Whatever, therefore, is essential to the "invention must be read out of the prior publication. If specific "details are necessary for the practical working and real utility "of the alleged invention, they must be found substantially in "the prior publication.

"Apparent generality, or a proposition not true to its full "extent, will not prejudice a subsequent statement which is "limited and accurate, and gives a specific rule of practical ap- "plication.

"The reason is manifest, because much further information, "and therefore much further discovery, are required before the "real truth can be extricated and embodied in a form to serve

"*and the plate at the part where the tooth is to be fixed are both "moistened with ether, and they are pressed in contact till the "solvent evaporates, when they will be found firmly attached the "one to the other.*"

Record, p. 490.

It is to be observed that Macintosh prepares his collodion in the (then) ordinary manner, or, to increase its toughness, mixes with it a small quantity of short cotton fibre and *evaporates the solvent until the collodion is brought to a plastic and putty-like state*. For hardness he adds to and thoroughly incorporates with it powdered gum copal. This plastic, putty-like compound he packs into the mould as in using the vulcanizable rubber compound.

In the other case, where he uses a sheet of his collodion, he first renders the sheet plastic by heat, and uses metal moulds. He also in such case moulds the plate after removing the teeth, and after the plate is made he attaches the teeth by metal pins, or else softens the plate with ether, and thus cements the teeth to the plate.

It thus appears on the face of the Macintosh patent that although he was familiar with the mould having the teeth inserted therein, and although he used that mould in connection with the putty-like collodion from which the solvent had not entirely disappeared and moulded that material "as in making teeth of vulcanite," yet when he proposed to use the *sheet* of collodion which he describes, he was compelled to resort to a different method, and, moulding the plate separately, attached the teeth afterward by pins and liquid solvents.

From this the inference is forcible that Macintosh's *sheet of collodion* was not susceptible of the treatment by which the celluloid dental plate blank is moulded around the teeth, as described in the Hyatt patents.

This capacity of celluloid being remoulded into any desired form or shape is due to the fact that celluloid contains a large proportion of camphor.

Record, p. 252.

"tion of gun-cotton or fibre in a solvent. The following is the "manner in which I prefer to proceed."

He then describes the process of making the mould:

"The collodion to be employed may be prepared in the or- "dinary manner; and I prefer, in order to increase its tough- "ness, to mix with it a small quantity of short cotton fibre, and "I evaporate the solvent until the collodion is brought to a "plastic and putty-like state. If it be desired to obtain a hard "setting, I add to the collodion and thoroughly incorporate "with it powdered gum copal, in quantity varying according to "the hardness desired; if great hardness is required, I use as "much as 20 per cent."

The specification further describes a mode of making a set of teeth upon a plate or thin, flexible setting.

"If it be desired to obtain a plate or thin, flexible setting, I "proceed in a similar manner to that already described, but I "produce the two forms of which the mould consists *in a readily "fusible metal (a mixture of tin and lead answers well) in place "of in plaster as before described; but in this case, after producing "the wax model the teeth are not left in it whilst the plaster cast "is taken, but are first carefully removed.* The collodion is "formed into a sheet of the desired thickness, and there is cut "out from this sheet, with the assistance of a template previ- "ously prepared by measuring from the mould, a piece of suit- "able form to produce the setting. I then lay the piece of "sheet collodion, *previously rendered plastic by heat,* in its place "in one-half of the mould, and the other half is then put over "the first and pressed firmly down upon it by the use of a "screw-box, as before explained. The mould is heated to "about 200° Fahrenheit, so as to keep the collodion perfectly "plastic, and the pressure applied is sufficient to force the col- "lodion into every crevice of the mould. When the mould is "cold and the collodion is set, the collodion plate is removed. *"The teeth are afterwards fitted in their places on the plate, and "are fixed either by metal pins or, as is preferred, the teeth are, "as before mentioned, made with a passage up the centre, which "is filled with collodion, and afterwards the collodion in the tooth*

"compound, which may be colored or combined with other "substances, and this I work up with any suitable machinery "until well blended or incorporated, when it may be rolled or "pressed into sheets or other forms; when dry it is very hard "and water-proof."

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No reference is made to this patent by any witness in this case, and it seems sufficient to say that it does not describe any use of camphor in compounding the collodion, nor does it describe solid collodion in the sense of the Hyatt patents. It certainly does not describe the Hyatt method of making celluloid, nor the product of that process.

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of Hyatt's celluloid, of which the letters patent themselves are *prima facie* evidence, must be considered to be unshaken.

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In May, 1852, Cummings filed a caveat in the Patent Office, in which he described his invention. His original application for a patent was made in April, 1855.

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Solid collodion was not known then, so far as the evidence in this case shows, when Cummings first described his invention and made application for a patent.

In describing his invention, both in his caveat and original specification, he declares it to consist "in forming the plate, and "also the gums in which the teeth are inserted, of rubber or "*some other elastic material.*"

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Of course, in the present proceeding the function of a jury is discharged by the court. The court, however, cannot, any more than the jury could, find that the thing denoted by the Hyatt specification as solid collodion is the same as the thing denoted by the specifications of the four several alleged anticipating patents in the entire absence of any evidence on the question.

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You may read and reread the specifications of these Cutting, Parkes, Barnwell & Rollason, and Macintosh patents, and you will nowhere find either the ingredients of celluloid as used by Hyatt, or the process of using them, or any product having the peculiar properties, and, for use in a dental plate, the absolutely essential property, which his product—celluloid—possesses.

The conclusion is therefore irresistible that "*such knowledge* "*as will enable the public to perceive the very discovery and carry* "*the invention into effect*" is found nowhere in these patents of Cutting, Parkes, Barnwell & Rollason, or Macintosh.

The Macintosh patent does not describe the compound of nitro-cellulose and camphor, which constitutes the subject-matter of the Hyatt Patent of July 12th, 1870, nor the method of producing that compound ~~over~~ nor the method of making the dental plate blank described in the Hyatt & Perkins Patent of March 28th, 1871; nor the method of making a set of teeth upon such a blank; nor the apparatus employed in moulding such sets of teeth, as patented to the Hyatts in December, 1871.

Neither celluloid nor the method of making and of using celluloid is to be found described in the Macintosh patent.

In Hill *vs.* Evans, 4 DeGex, Fisher and Jones, 300, Lord Westbury says:

"One of the means of imparting knowledge to the public is "the publication of a book, or the recording of a specification "of a patent. If, therefore, in disproving that allegation which "is involved in every patent, that the invention was not pre-"viously known, appeal be made to an antecedently published "book or specification, the question is, What is the nature and "extent of the information thus acquired, which is necessary "to disprove the novelty of the subsequent patent? There is "not, I think, any other general answer that can be given to "this question than this: that the information as to the alleged "invention given by the prior publication must, for the pur-"poses of practical utility, be equal to that given by the subse-"quent patent. The invention must be shown to have been be-"fore made known. Whatever, therefore, is essential to the "invention must be read out of the prior publication. If specific "details are necessary for the practical working and real utility "of the alleged invention, they must be found substantially in "the prior publication.

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"The reason is manifest, because much further information, "and therefore much further discovery, are required before the "real truth can be extricated and embodied in a form to serve

" and the plate at the part where the tooth is to be fixed are both " moistened with ether, and they are pressed in contact till the " solvent evaporates, when they will be found firmly attached the " one to the other."

Record, p. 490.

It is to be observed that Macintosh prepares his collodion in the (then) ordinary manner, or, to increase its toughness, mixes with it a small quantity of short cotton fibre and *evaporates the solvent until the collodion is brought to a plastic and putty-like state*. For hardness he adds to and thoroughly incorporates with it powdered gum copal. This plastic, putty-like compound he packs into the mould as in using the vulcanizable rubber compound.

In the other case, where he uses a sheet of his collodion, he first renders the sheet plastic by heat, and uses metal moulds. He also in such case moulds the plate after removing the teeth, and after the plate is made he attaches the teeth by metal pins, or else softens the plate with ether, and thus cements the teeth to the plate.

It thus appears on the face of the Macintosh patent that although he was familiar with the mould having the teeth inserted therein, and although he used that mould in connection with the putty-like collodion from which the solvent had not entirely disappeared and moulded that material " as in making teeth of vulcanite," yet when he proposed to use the *sheet* of collodion which he describes, he was compelled to resort to a different method, and, moulding the plate separately, attached the teeth afterward by pins and liquid solvents.

From this the inference is forcible that Macintosh's *sheet of collodion* was not susceptible of the treatment by which the celluloid dental plate blank is moulded around the teeth, as described in the Hyatt patents.

This capacity of celluloid being remoulded into any desired form or shape is due to the fact that celluloid contains a large proportion of camphor.

Record, p. 252.

"tion of gun-cotton or fibre in a solvent. The following is the "manner in which I prefer to proceed."

He then describes the process of making the mould:

"The collodion to be employed may be prepared in the or- "dinary manner; and I prefer, in order to increase its tough- "ness, to mix with it a small quantity of short cotton fibre, and "I evaporate the solvent until the collodion is brought to a "plastic and putty-like state. If it be desired to obtain a hard "setting, I add to the collodion and thoroughly incorporate "with it powdered gum copal, in quantity varying according to "the hardness desired; if great hardness is required, I use as "much as 20 per cent."

The specification further describes a mode of making a set of teeth upon a plate or thin, flexible setting.

"If it be desired to obtain a plate or thin, flexible setting, I "proceed in a similar manner to that already described, but I "produce the two forms of which the mould consists *in a readily* "*fusible metal* (*a mixture of tin and lead answers well*) *in place* "*of in plaster as before described; but in this case, after producing* "*the wax model the teeth are not left in it whilst the plaster cast* "*is taken, but are first carefully removed.* The collodion is "formed into a sheet of the desired thickness, and there is cut "out from this sheet, with the assistance of a template previ- "ously prepared by measuring from the mould, a piece of suit- "able form to produce the setting. I then lay the piece of "sheet collodion, *previously rendered plastic by heat*, in its place "in one-half of the mould, and the other half is then put over "the first and pressed firmly down upon it by the use of a "screw-box, as before explained. The mould is heated to "about 200° Fahrenheit, so as to keep the collodion perfectly "plastic, and the pressure applied is sufficient to force the col- "lodion into every crevice of the mould. When the mould is "cold and the collodion is set, the collodion plate is removed. "*The teeth are afterwards fitted in their places on the plate, and* "*are fixed either by metal pins or, as is preferred, the teeth are,* "*as before mentioned, made with a passage up the centre, which* "*is filled with collodion, and afterwards the collodion in the tooth*

"compound, which may be colored or combined with other "substances, and this I work up with any suitable machinery "until well blended or incorporated, when it may be rolled or "pressed into sheets or other forms; when dry it is very hard "and water-proof."

Record, p. 211.

No reference is made to this patent by any witness in this case, and it seems sufficient to say that it does not describe any use of camphor in compounding the collodion, nor does it describe solid collodion in the sense of the Hyatt patents. It certainly does not describe the Hyatt method of making celluloid, nor the product of that process.

3d. Barnewell & Rollason's Patent of 1860. Complainants' Exhibit Q. Record, pp. 212, 219.

This patent describes a process of mixing solutions of pyroxiline with animal, vegetable, and mineral substances, by which its quality is altered in such manner as to produce hard, resistent, adhesive, plastic, or resilient compounds.

"Our invention consists in dissolving pyroxiline in any of "its known solvents and adding thereto oils,—animal, vege-"table, or mineral,—varying in their nature and their action "with pyroxiline, selecting any of these to suit any particular "views we may entertain relative to the subsequent use of the "compound."

Of this long specification it is only necessary to further quote the following as to the mode of using the compound (p. 216):

"If in a plastic state, then it may be treated as a paste: if in "a fluid condition, it may be poured or brushed upon the mould, "or the mould may be immersed in it until by adding coat upon "coat sufficient thickness has been acquired, and as each coat "attains the desired condition, that is to say, dry or partially "so, according to circumstances, we can introduce a coat or "sheet of any material, to make up thickness and inflexibility, "such as varnish, starch, gelatine, afterwards proceeding to "apply thereupon an additional coat or coats of our compound;

"but if flexibility be desired, we should avoid the use of any "of these intermediate materials.

"Another mode in which we can manufacture buttons and "other solid forms is by stamping, pressing, or cutting them "*out of a sheet of the material previously formed into a sheet by* "*repeated coatings or layers of the compound in solution, in which* "*state we also employ it for coating and insulating telegraph wires*, "whether such wires have been already protected by covering "of any kind, or upon the bare metal. The solution is also a "complete protective coating for percussion-caps. A film "formed on the inside or a thin washer placed therein, thor- "oughly and effectually preserves the charge of detonating "mixture from damp."

No reference is made to this patent by any witness in the case, and it seems sufficient to say that it does not describe any use of camphor nor any compound of camphor and pyroxiline. It does not describe or indicate the Hyatt process of making solid collodion or celluloid, and it does not describe the product of that process.

These three patents were introduced by complainants at the close of their rebutting testimony.

In addition to these there is

4th. Macintosh's Patent of 1859. Record, p. 488.

This was introduced by defendant in the Smith case to show that it contained the description of the process of making the mould as described in Cummings' reissue.

E. S. Renwick, p. 387, Q. 7.

The patentee says, p. 489:

"This invention has for its object improvements in setting "artificial teeth, and consists in employing for this purpose the "preparation known by the name of collodion, which is a solu-

"tion of gun-cotton or fibre in a solvent. The following is the "manner in which I prefer to proceed."

He then describes the process of making the mould:

"The collodion to be employed may be prepared in the or- "dinary manner; and I prefer, in order to increase its tough- "ness, to mix with it a small quantity of short cotton fibre, and "I evaporate the solvent until the collodion is brought to a "plastic and putty-like state. If it be desired to obtain a hard "setting, I add to the collodion and thoroughly incorporate "with it powdered gum copal, in quantity varying according to "the hardness desired; if great hardness is required, I use as "much as 20 per cent."

The specification further describes a mode of making a set of teeth upon a plate or thin, flexible setting.

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" and the plate at the part where the tooth is to be fixed are both " moistened with ether, and they are pressed in contact till the " solvent evaporates, when they will be found firmly attached the " one to the other."

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It is to be observed that Macintosh prepares his collodion in the (then) ordinary manner, or, to increase its toughness, mixes with it a small quantity of short cotton fibre and *evaporates the solvent until the collodion is brought to a plastic and putty-like state*. For hardness he adds to and thoroughly incorporates with it powdered gum copal. This plastic, putty-like compound he packs into the mould as in using the vulcanizable rubber compound.

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It thus appears on the face of the Macintosh patent that although he was familiar with the mould having the teeth inserted therein, and although he used that mould in connection with the putty-like collodion from which the solvent had not entirely disappeared and moulded that material " as in making teeth of vulcanite," yet when he proposed to use the *sheet* of collodion which he describes, he was compelled to resort to a different method, and, moulding the plate separately, attached the teeth afterward by pins and liquid solvents.

From this the inference is forcible that Macintosh's *sheet of collodion* was not susceptible of the treatment by which the celluloid dental plate blank is moulded around the teeth, as described in the Hyatt patents.

This capacity of celluloid being remoulded into any desired form or shape is due to the fact that celluloid contains a large proportion of camphor.

Record, p. 252.

The Macintosh patent does not describe the compound of nitro-cellulose and camphor, which constitutes the subject-matter of the Hyatt Patent of July 12th, 1870, nor the method of producing that compound ~~over~~ nor the method of making the dental plate blank described in the Hyatt & Perkins Patent of March 28th, 1871; nor the method of making a set of teeth upon such a blank; nor the apparatus employed in moulding such sets of teeth, as patented to the Hyatts in December, 1871.

Neither celluloid nor the method of making and of using celluloid is to be found described in the Macintosh patent.

In Hill *vs.* Evans, 4 DeGex, Fisher and Jones, 300, Lord Westbury says:

"One of the means of imparting knowledge to the public is "the publication of a book, or the recording of a specification "of a patent. If, therefore, in disproving that allegation which "is involved in every patent, that the invention was not pre- "viously known, appeal be made to an antecedently published "book or specification, the question is, What is the nature and "extent of the information thus acquired, which is necessary "to disprove the novelty of the subsequent patent? There is "not, I think, any other general answer that can be given to "this question than this: that the information as to the alleged "invention given by the prior publication must, for the pur- "poses of practical utility, be equal to that given by the subse- "quent patent. The invention must be shown to have been be- "fore made known. Whatever, therefore, is essential to the "invention must be read out of the prior publication. If specific "details are necessary for the practical working and real utility "of the alleged invention, they must be found substantially in "the prior publication.

"Apparent generality, or a proposition not true to its full "extent, will not prejudice a subsequent statement which is "limited and accurate, and gives a specific rule of practical ap- "plication.

"The reason is manifest, because much further information, "and therefore much further discovery, are required before the "real truth can be extricated and embodied in a form to serve

"the use of mankind. It is the difference between the ore and "the refined and pure metal which is extracted from it.

"Again, it is not, in my opinion, true in these cases to say "that knowledge, and the means of obtaining knowledge, are "the same. There is a great difference between them. To "carry me to the place at which I wish to arrive is very differ- "ent from merely putting me on the road that leads to it. There "may be a latent truth in the words of a former writer, not "known even to the writer himself; and it would be unreason- "able to say that there is no merit in discovering it and unfold- "ing it to the world.

"Upon principle, therefore, I conclude that the prior knowl- "edge of an invention to avoid a patent must be knowledge "equal to that required to be given by a specification; namely, "such knowledge as will enable the public to perceive the "very discovery, and to carry the invention into practical use."

The knowledge that was essential to Hyatt's invention of celluloid was the knowledge that comminuted camphor remained inert when mechanically mixed with pyroxyline at ordinary temperature,—and yet became an active solvent of the pyroxyline when the mixture is subjected to heat above the ordinary temperature.

The discovery of this fact by Hyatt was the foundation of his invention. Where, in any prior publication, search them as you will, can you find even a hint of this fact?

"Whatever is essential to the invention must be read out of "the prior publication."

You may read and reread the specifications of these Cutting, Parkes, Barnwell & Rollason, and Macintosh patents, and you will nowhere find either the ingredients of celluloid as used by Hyatt, or the process of using them, or any product having the peculiar properties, and, for use in a dental plate, the absolutely essential property, which his product—celluloid—possesses.

The conclusion is therefore irresistible that "*such knowledge "as will enable the public to perceive the very discovery and carry "the invention into effect*" is found nowhere in these patents of Cutting, Parkes, Barnwell & Rollason, or Macintosh.

Furthermore, the letters patent granted for celluloid, and for its treatment, and for the apparatus with which it is treated, are *prima facie* evidence of the novelty of the material and the processes.

There is therefore not only no presumption of law that celluloid was known at or before 1864, the date of Cummings' patent, but there is a presumption to the contrary raised by the introduction of these Hyatt patents under the pleadings in this case, which throws upon the appellant the burden of proving the alleged equivalency of the material, and the fact of its known existence at the date of the Cummings patent.

The argument on this point might safely be allowed to rest here, but there is another reason, equally conclusive, why these four prior patents must be discarded as not containing a description of Hyatt's celluloid.

In comparing specifications, the first duty of the court is to determine the legal construction of each document. "But "after that duty is discharged there would remain a most im- "portant function to be still performed, which is the comparison "of the two instruments when they have received their legal "exposition and interpretation; and, as it is a matter of evi- "dence what external thing is indicated and denoted by any "description, when the *jury* have been informed of the mean- "ing of the description contained in each specification, the "work of comparing the two and ascertaining whether the "words (as interpreted by the court) contained in specification "(A) do or do not denote the same external matter as the "words (as interpreted and explained by the court) contained "in specification (B) is a matter of fact, and is, I conceive, a "matter within the province of the jury, and not within the "function of the court."

Hill *vs.* Evans, *ubi supra*, 295.

THE APPELLANT ASKS THE COURT TO SUPPLEMENT THE PROOF OF INFRINGEMENT IN THIS CASE BY COMPARING THESE FOUR PATENTS WITH THE HYATT PATENTS OF 1870 AND 1871, AND TO DECIDE, UPON SUCH COMPARISON,

I. THAT, AS MATTER OF LAW, THE DEFENDANT, IN MAKING A DENTAL PLATE OF HYATT'S CELLULOID BY THE PROCESSES PATENTED TO HYATT IN 1871, HAS USED A MATERIAL KNOWN AS AN EQUIVALENT OF HARD RUBBER OR VULCANITE IN 1864, AND A PROCESS KNOWN IN 1864 AS AN EQUIVALENT OF THE VULCANIZING PROCESS.

II. THAT, AS MATTER OF LAW, THE HYATT CELLULOID AND THE HYATT PROCESSES, PATENTED IN 1870 AND 1871, WERE IN 1864 KNOWN EQUIVALENTS OF THE GOODYEAR VULCANIZABLE COMPOUND AND THE GOODYEAR VULCANIZING PROCESSES, AND THAT SUCH PRIOR KNOWN EQUIVALENTS ARE DESCRIBED AS SUCH IN THE CUTTING, PARKES, BARNWELL & ROLLASON, AND MACINTOSH PATENTS.

Of course, in the present proceeding the function of a jury is discharged by the court. The court, however, cannot, any more than the jury could, find that the thing denoted by the Hyatt specification as solid collodion is the same as the thing denoted by the specifications of the four several alleged anticipating patents in the entire absence of any evidence on the question.

This court has more than once had occasion to state that it is not its province to compare such documents as these patents and decide on the identity or the diversity of the inventions.

Bischoff *vs.* Wethered, 9 Wall., 813, 816.

And it has even said that *it has no right to decide that one patent covers the invention of another, or that it did not.*

Tucker *vs.* Spaulding, 13 Wall., 455, 456.

In the present case—for reasons no doubt deemed sufficient—the complainant did not call a single witness to say whether the thing denoted by any of the several specifications is the same as celluloid, and there is no such evidence in the record.

In view, then, of the difference apparent on the face of the specifications between old solid collodion and celluloid, coupled with the fact of the absence of any evidence to show that the things described in the specification are the same, the novelty

of Hyatt's celluloid, of which the letters patent themselves are *prima facie* evidence, must be considered to be unshaken.

If, then, celluloid was not known prior to 1870, it cannot be comprised within the Cummings patent, no matter how wide the construction may be which is put upon that patent.

FOURTH.

A CELLULOID DENTAL PLATE CANNOT BE COMPREHENDED WITHIN ANY CONSTRUCTION THAT CAN BE PUT UPON THE CUMMINGS PATENT, BECAUSE CELLULOID WAS NOT KNOWN AT THE DATE OF THE CUMMINGS APPLICATION.

In May, 1852, Cummings filed a caveat in the Patent Office, in which he described his invention. His original application for a patent was made in April, 1855.

There is no evidence showing the existence of such a thing as solid collodion at the time when the caveat in which he describes his invention was filed.

The earliest mention of anything in the nature of solid collodion is in the Cutting patent, which was published in January, 1855 (Record, p. 205), and, it will be remembered, this patent only describes pouring liquid collodion over a plate of glass and allowing it to dry, so as to form a thin film on the surface of the glass for the purpose of taking ambrotypes.

Solid collodion was not known then, so far as the evidence in this case shows, when Cummings first described his invention and made application for a patent.

In describing his invention, both in his caveat and original specification, he declares it to consist "in forming the plate, and "also the gums in which the teeth are inserted, of rubber or "*some other elastic material.*"

If instead of using the words "*some other elastic material*" Dr. Cummings had specified everything which in the *then* state of the art could have been substituted for rubber, his specification would have been just as broad, and would not have named solid collodion, because it was not known at that time.

If solid collodion of a kind fitted for the making of a dental plate had been invented or discovered in the interval between

the original application of Dr. Cummings and the date of his letters patent (June 7th, 1864), and he had amended his application so as to specifically cover the new invention or discovery, such addition would not be within the protection of the patent.

This court, in a very recent case (Railway Co. *vs.* Sayles, 7 Otto, 554), has decided that an application cannot be thus enlarged.

Mr. Justice Bradley, in delivering the opinion of the court, says, on page 563:

"The law does not permit such enlargements of an original "specification—which would interfere with other inventors who "have entered the field in the mean time—any more than it "does in the case of reissues of patents previously granted. "Courts should regard with jealousy and disfavor any attempts "to enlarge the scope of an *application once filed*, or of a patent "once granted, the effect of which would be to enable the "patentee to appropriate other inventions made prior to such "alterations, and to appropriate that which has in the mean "time gone into public use."

HENRY BALDWIN, JR.,
WM. D. SHIPMAN,
Counsel for Appellee.

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H. McKENNEY

SUPREME COURT of the UNITED STATES.

THE GOODYEAR DENTAL VULCANITE COMPANY,

Appellant,

agst.

CHARLES G. DAVIS.

Appeal from the Circuit Court of the United States for the District of Massachusetts.

PRINTED ARGUMENT

SUBMITTED BY

WILLIAM D. SHIPMAN,

Of Counsel for the Appellee.

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1880.

Supreme Court of the United States.

THE GOODYEAR DENTAL VULCANITE COMPANY,
Appellants,
agst.
CHARLES G. DAVIS.

APPEAL FROM THE CIRCUIT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MASSACHUSETTS.

Printed Argument submitted by William D. Shipman, of Counsel for the *Appellee*.

This is a bill in equity for an injunction and an account, brought in the Circuit Court of the United States, for the District of Massachusetts, and heard before his Honor Judge SHEPLEY, who dismissed the bill, whereupon the plaintiffs have brought the case by appeal into this Court.

The object of the present argument will be to show that there has been no infringement of the rights of the complainant, and that the bill was therefore properly dismissed by the court below. This question will depend, in connection with the conceded, or, at least, undeniable facts, upon the proper construction of the reissued patent upon which the complainants' suit is founded.

This patent, familiarly known to the courts as the "Cummings Patent," has been the subject of strongly contested litigations, and has been repeatedly construed by the Circuit Courts, and once at least, by this Court.

In the bill many suits brought by these complainants are re-

ferred to for the purpose of strengthening the present case. I shall have occasion in this argument to refer especially to three of these cases, to wit:

The Goodyear Dental Vulcanite Company *vs.* Isaac J. Wetherbee, decided at the May Term, 1866, in the Circuit Court of Massachusetts (2 Cliff. R., p. 555).

The Goodyear Dental Vulcanite Company *vs.* Benoni E. Gardiner, decided in the Circuit Court in Rhode Island, June Term, 1871 (3 Cliff. R., p. 408).

The Goodyear Dental Vulcanite Company *vs.* Daniel H. Smith, decided in the Circuit Court of Massachusetts, May, 1874 (1 Holmes R., p. 354), and affirmed in this court, October Term, 1876 (3 Otto, p. 486).

In these cases the appellant contended for, and obtained a construction of the patent which, as we shall respectfully submit, negatives the claim of infringement set up in the present case. To overcome this difficulty, it now seeks to repudiate the construction of the Cummings patent, which it has heretofore successfully contended for, and asks to have that construction enlarged so as to conclude the process and manufacture of this defendant. It will therefore be pertinent to give a brief history of the prior litigations, and especially of the case of the complainant against Smith. The record of this latter case in the Circuit Court forms a part of the present Record.

Before examining the facts in this case, it is important to ascertain the true construction of the "Cummings Patent," and on this point it will be instructive to examine—

First.—The specification of the reissued patent, No. 1904, upon which the present suit is founded.

Second.—The specification of the original patent, No. 43,009, and its history in the Patent Office, as presented in Record.

Third.—The description of the invention of Cummings, put forth by the complainant through its witnesses in former suits, and made a part of the present Record.

Fourth.—The construction heretofore given to the reissued patent by the courts.

I.

The specification of the reissue patent upon which this suit is founded will be found at pp. 97, 98 and 99 of the Record. For convenience we here set it out at length, except the drawings, which will be found facing p. 98:

" To all persons to whom these presents shall come:

" Be it known, that I, John A. Cummings, of Boston, in the " County of Suffolk and State of Massachusetts, have invented " certain new and useful improvements in plates for artificial " teeth; and the following description, taken in connection " with the accompanying plate and drawings, hereinafter re- " ferred to, forms a full and exact specification of the same, " wherein I have set forth the nature and principles of my said " improvements, by which my invention may be distinguished " from all others of a similar class, together with such parts " as I claim and desire to have secured to me by Letters- " Patent.

" The method hitherto practiced of attaching artificial teeth " to a metallic plate fitting to the roof of the mouth, is " attended with many objections and inconveniences, as the " plate, being hard and unyielding, naturally hurts the mouth, " and, in some degree, impedes mastication and perfect artic- " ulation, while the expense of the metal employed prevents " many from availing themselves of the advantage of artificial " teeth.

" My present invention consists in forming the plate, to " which the teeth or teeth and gums are attached, *of hard rub-* " *ber, or "vulcanite," so-called—an elastic material* possessing " and retaining in use sufficient rigidity for the purpose of " mastication, and, at the same time, being pliable enough to " yield a little to the motions of the mouth.

" My manner of making and using said *hard rubber plates* is " as follows: A wax or plaster impression of that part of the " mouth which the plate is to fit is first taken, and from that " impression a plaster cast is made, which will exactly re- " semble that part of the mouth from which the first impres- " sion was taken. A plate of wax of the general form of the " intended *rubber* plate is then made from this plaster cast, " and around the front of this wax plate a vertical ridge of

" wax is fixed, about in the position which the teeth are to " occupy, in the same manner as is generally practiced in the " construction of gold plates for artificial teeth. A plaster " mould is then made from this wax plate, fitting it both on " the upper and under side, which plaster mould is known gen- " erally as the articulator, and is constructed so as to hold the " wax plate securely and conveniently for manipulation, leav- " ing the front edge, where the teeth are to be applied, ex- " posed and accessible. The figures of the accompanying plate " of drawings represent my improvements.

" Fig. 1 is a front elevation of a set of artificial teeth and " plate formed by my improved method.

" Fig. 2 is a view of the lower side of the plate and teeth.

" Fig. 3 is a central vertical section of the same.

" The teeth shown in the drawings are gum-teeth, so called; " that is, having porcelain gums formed in one piece with the " teeth, and properly colored; and they are shown each one " separate. But they may be without porcelain gums, in " which case the palate and gums will be formed in one piece, of " *hard rubber;* and if gum teeth, they may be formed in groups " of two or more, as desired. My mode of operation is the " same, whether gum-teeth or teeth alone are used, or separate " or in groups. The teeth are set in place in the wax plate, " and adjusted to the proper distance and fullness, in the same " manner as is generally practiced in setting teeth in gold " plates. In the drawing the gum-teeth are made separate, " and marked *a*, *a*. The wax plate and gums, with the teeth " adhering thereto, is now set upon the original plaster cast " of the corresponding part of the mouth, and plaster is poured " all round, up to about the lower edge (as it lies) of the wax " plate; the margin, or outlying surface of the plaster, is oiled " or varnished, and plaster poured over the whole, forming a " complete mould of the plate and teeth. Upon the opening " of this mould the wax is warmed and removed, so as to leave " the teeth adhering in the plaster mould in exactly the rela- " tive position they are to occupy in the *hard rubber plate.* " The teeth are provided with pins, *c*, *c*, projecting therefrom " in such a manner that the *rubber* which is to constitute the " plate will close around them, and by means of them hold or " secure the teeth permanently in position. The plaster mould, " with the teeth adhering therein, as just described, is now " filled with *soft rubber*, a little at a time, pressed in with the " finger, or in any other convenient way; and care is to be " taken that the *rubber* is made to completely fit into the cavi- " ties, and around the protuberances, including the pins, and " is filled into the thickness or depth desired to form the " plate. I then lock the *rubber plate* in position by shutting " the other half of the plaster mould over it, to insure its re-

" taining its exact form while warming, and then heat or *bake*
" it in an oven, or in any other suitable way. The *soft rubber*
" or gum, so inserted in the mould, is to be compounded
" with *sulphur, rubber,* etc., in the manner prescribed
" in the patent of Nelson Goodyear, dated May 6, A. D. 1851,
" for making *hard rubber,* and is to be subjected to sufficient
" heat to *vulcanize or harden it,* substantially as directed in
" that patent. It is also to be colored in imitation of the na-
" tural gums, by mixing it with vermillion, or other suitable
" coloring matter, while in the soft state. After the plate has
" been heated sufficient *to harden* it, or convert it into hard rub-
" ber or 'vulcanite,' so called, the mould is removed and the
" plate is polished, ready for use.

" Having thus described the method I have used for making
" and using said *hard rubber or vulcanite* plates, what I claim
" herein, and desire to secure by Letters Patent is

" The plate of *hard rubber or vulcanite,* or its equivalent, for
" holding artificial teeth, or teeth and gums, substantially as
" described.

" JOHN A. CUMMINGS.

" JOSEPH GAVETT.
" SAMUEL M. BARTON,
" *Witnesses.*"

A bare inspection of this specification reveals the fact that rubber, vulcanization and vulcanite, are essential elements in the invention, without which the claim process cannot be worked, nor the claimed product be produced, and the more closely the specification is scrutinized the more clearly does this appear.

It states that the invention consists in forming the plate of *hard rubber, or* " *vulcanite,*" so called.

The manner of making and using said *hard rubber plates* is then given.

A plate of wax, of the general form of the intended *rubber* plate is made.

In case the teeth are without porcelain gums, the palate and gums will be formed in one piece, of *hard rubber.*

The teeth are left adhering in the plaster mould in exactly the position they are to occupy in the *hard rubber plate.*

The teeth are provided with pins in such manner that the *rubber,* which is to constitute the plate, will close around them, and by means of them, hold or secure the teeth permanently in position.

The plaster mould, with the teeth adhering therein, as just described, is now *filled with* SOFT RUBBER *a little at a time*, pressed in with the finger, or in any other convenient way.

Care is to be taken that the *rubber* is made to completely fit into the cavities and around the protuberances, including the pins, and is filled in to the thickness or depth desired *to form the plate.*

The *rubber plate* is then locked in position, &c.

The soft rubber or gum so inserted into the mould is to be compounded with sulphur, rubber, etc., in the manner PRESCRIBED *in the patent of Nelson Goodyear, dated May 6th*, 1851, *for making hard rubber, and is to be subjected to sufficient heat to* VULCANIZE OR HARDEN *it substantially as* DESCRIBED *in that patent.*

It is also to be colored *in imitation of the natural gums* by mixing it with vermillion or other suitable coloring matter *while in the soft state.*

After the plate has been heated sufficiently to harden it or convert it into hard rubber or "vulcanite," so called, the mould is removed.

Having thus described the method I have used for making and using said *hard rubber or vulcanite plates, what I claim herein,* and desire to secure by Letters Patent, is:

The plate of *hard rubber or vulcanite or its equivalent*, for holding artificial teeth or teeth and gums, substantially as described.

It appears thus that the substance to be used is named in the specification *fifteen* times—eight times as "*hard rubber*," or "*hard rubber or vulcanite*," once as "*soft rubber*," once as "*soft rubber or gum*," and five times as "*rubber*." In addition to this, both the hard and soft conditions of the material and its transition from one to the other are referred to as governed by the Goodyear patent. Whether the soft rubber or gum be caoutchouc or some other gum, it is to be compounded with sulphur, &c., and to be *vulcanized* conformably with the Goodyear patent. This Goodyear patent is printed in the Record pp. 441, 442, 443, Exhibit 2.

It states at foot of p. 442. "The *indispensible ingredients used* in my composition are CAOUTCHOUC and SULPHUR, the minimum proportions of *sulphur* being about four ounces to the pound of caoutchouc, in which respect, &c."

In the case of the Dental Vulcanite Company *v.* Wetherbee, Mr. Justice Clifford held that "*the claim of the patent* (*Cummings'*) *conforms to the description of the invention* as given in the specification, and it is not perceived that *any form of words* can render it more *definite*. Infringement is admitted."

2 Cliff, pp. 565, 566.

We respectfully insist that if this patent were now for the first time submitted to the Court for construction, the only one that could be given to it is that which includes *rubber, vulcanization* and *vulcanite*, as essential features of the invention described and claimed.

Strike out these elements and there is no invention either described or claimed; no possible mode of making a set of teeth and plate resembling those supposed to have been invented by Cummings even hinted at. Strike out rubber and there is no material suggested which can answer the purpose. Leave rubber in and strike out vulcanization and the plate is soft as putty and utterly worthless, there is no hard rubber or vulcanite. Retain both rubber and vulcanization and the process can be worked and the product claimed, viz.: "The plate of *hard rubber or vulcanite or its equivalent*, for holding artificial teeth or teeth and gums, substantially as described," is the result.

The construction now asked for by the complainant disregards the plain language of the specification. It, in effect, calls upon the court to treat the specification as a slate, draw a wet sponge over it, and write an entirely new instrument.

II.

The original specification of Cummings, though loosely drawn, when read in connection with the claim, confined the invention to a dental set in which the teeth are inserted in one piece of *hard rubber or vulcanite*. This specification is printed on pp. 90, 91, of the Record, and is as follows:

"The schedule referred to in these Letters Patent, and "making part of the same.

" *To all persons to whom these presents shall come:*

" Be it known, that I, John A. Cummings, of Boston, in the " County of Suffolk, and State of Massachusetts, have in- " vented certain new and useful improvements in the manner " of forming artificial palates and gums used for inserting arti- " ficial teeth; and that the following description, taken in con- " nection with the accompanying drawings, hereinafter refer- " red to, forms a full and exact specification of the same, " wherein I have set forth the nature and principles of my said " invention, by which it may be distinguished from others of a " similar class, together with such parts as I claim and desire " to have secured to me by Letters Patent.

" The figures of the accompanying plates of drawings re- " present my improvements.

" Fig. 1 is a front elevation of a set of artificial teeth and " plate formed by my improved method.

" Fig. 2 is a view of the lower side of the plate and teeth.

" Fig. 3 is a central vertical section of the same.

" The method hitherto practiced of attaching artificial teeth " to a metallic plate, fitting to the roof of the mouth, is at- " tended with many objections and inconveniences, as the " plate, being hard and unyielding, naturally hurts the mouth, " and in some degree impedes mastication and perfect articu- " lation, while the expense of the metal employed prevents " many from availing themselves of the advantage of artificial " teeth.

" The present invention consists in forming the plate and " gums, to which the teeth are attached, of rubber, or some " other elastic material, so indurated as to be rigid enough for " the purpose of mastication, and pliable enough to yield a " little to the motions of the mouth, and in one piece, the " teeth being embedded in the elastic material while the said " material is in a soft condition, and then *baked* with the gums " and plate, so that the teeth, gums and plate will all be con- " nected, forming as it were, one piece.

" *a a a*, &c., in the drawings, represent the artificial teeth, " prepared in the usual manner. The plate and gums *b b* " are formed of one piece, and of rubber or of rubber and the " compounds commonly employed therewith, or of gutta- " percha, or in fact of any elastic substance which can be " reduced to a soft condition, and then vulcanized or hardened " sufficiently to answer the purpose. The rubber or other " material used is first moulded to fit the shape of the mouth, " and the gums formed, and, while soft and pliable, the teeth, " *a a*, are embedded in the gums, and, as an additional security, " fastened to the same by small pins, *c c*, fig. 3. The teeth, " gums, and plate, being thus connected, are then *baked* until " the elastic material becomes sufficiently *vulcanized*, when the

" process is completed, the plate being hard and rigid enough " for the purposes of mastication, and yet by its elastic nature " yielding to the motions of the mouth, while the teeth are " firmly embedded and secured in the gums.

" The plate and gums can be colored in any proper manner " to imitate nature.

" Having thus described my invention, I shall state my claim " as follows:

" What I claim as my invention, and desire to have secured " to me by Letters Patent, is:

" Forming the plate and gums in which the teeth are in- " serted in one piece of hard rubber or vulcanite, *i. e.*, an " elastic material which can be hardened sufficiently for the " purpose of mastication, and retain a portion of its elasticity " so as to yield a little to the motion of the mouth, as herein " set forth, and for the purposes specified.

" JOHN A. CUMMINGS.

" Witnesses:
" A. POLLOK,
" J. L. COOMBS."

It was decided by his Honor, Judge Shepley, in the Smith case (1 Holmes R., p. 354), that the reissued patent, No. 1,904, was for the same invention described and claimed in this original specification. And in his Honor's opinion in that case he says, after stating what the invention is not, that the patent " is for a set of artificial teeth, as a new article of manufacture, " consisting of a plate of *hard rubber or vulcanite*, with teeth, " or teeth and gums secured thereto in the manner described " in the patent, by embedding the teeth and pins in the *vulcan-* " *izable compound*, so that it shall surround the teeth and pins " while the compound is in a soft state before it is *vulcanized*, " so that when the compound is *vulcanized*, the teeth are firmly " secured, &c." * * * " This manufacture was a new man- " ufacture—new as to the thing made, new as to the process " of making it, *considering that process as a whole.*" His Honor " then adds, referring to the caveat filed by Cummings, May " 14th, 1852 (printed in Record, pp. 161, 162): " It is evident " from an examination of the very brief and imperfect descrip- " tion of the invention, given by Cummings in his caveat * * " that he fully appreciated the fact that the importance of his " invention consisted *not merely in the substitution of a material* " *rigid enough for the purposes of mastication, and pliable enough to* " *yield a little to the mouth;* in place of the hard, unyielding

" metals previously used, and *not merely in the substitution of a* " *material light and inexpensive*, in place of the expensive and " heavy materials before used for the plate, but *also* in the ad- " ditional fact which he states, that by this improvement the " teeth can be easily *baked* into the gums, which form one piece " with the plate. This statement at that early period sufficiently " suggests that he fully appreciated the advantages of the *mate-* " *rial which he used*, and which was capable of *being so used in* " *the process, &c.*"

So, too, in the same case on appeal in this court (3 Otto, p. 499), it was held that the reissued Letters Patent were for the same invention described in the original specification. Mr. Justice Strong, in delivering the opinion of the court, says :

"It is further insisted by the defendant that the reissued " patent on which this suit is founded is not a patent for the " same invention which was described in the specification of " the original patent, and, therefore, that the reissue is un- " authorized and void. To sustain this position the defendant " must overcome the presumption against him arising from " the decision of the Commissioner of Patents in granting the " issue ; and this he can do only by showing, from a compari- " son of the original specification with that of the reissue, that " the former does not substantially describe what is described " and claimed in the latter. This must plainly appear before " we can be justified in pronouncing the reissued patent void. " But this, in our judgment, does not appear. The first speci- " fication describes a set of artificial teeth, having a hard-rub- " ber plate, made by a process substantially the same as that " indicated in the later patent. The description of the pro- " cess is not quite so minute, but it is sufficiently full to be " understood, and to enable an operator to make the manufac- " ture. Certainly it is not another process ; and as its result " is the same, it is impossible to hold that the reissued patent " is for a different invention from the one protected by the " original patent. It is true, the specification of the reissue " describes also another process not described in the specifi- " cation of the first, namely, a mode of making the moulds ; " but that is not claimed as part of the invention."

Now, on comparing the body of this original specification with that of reissue 1,904, it will be seen that a careful scrutiny of the former was instituted, and every word (and there were many), which could tend to the broad construction now contended for by the complainant, was excluded from the reissue.

The whole instrument was searched as with lighted candles, and cleansed of every loose or doubtful expression. This was undoubtedly done in view of what had taken place in the Patent Office prior to the granting of the original patent, the evidence of which was on file (and is incorporated by the complainant in its record in this case), and for the purpose of preventing the very construction now insisted on by the complainant; a construction *then* deemed dangerous in view of the state of the art, and which now is in conflict with the repeated declarations and disclaimers of the inventor, and in violation of the express understanding of the commissioner when he finally granted the original.

In support of this statement, we cite here the documentary evidence, mostly put in by the complainant, and submit it without further comment:

"BOSTON, *July 30th*, 1855.

"DEAR SIR: With this I return you the specification of John "A. Cummings' imprvts. in sets of artificial teeth. After ex- "amining the references in the letter from the office of May "19th more carefully, Mr. Cummings has amended his speci- "fication and taken the oath of invention, and having stricken "out all reference to gutta-percha. In the originating this "invention Mr. Cummings *supposed* that he was first in the "use of mineral teeth, &c., with a *gum which becomes plastic by* "*heat and hardens by cooling;* but he had always intended to "use the *vulcanized rubber* as the best material, and only put "in gutta-percha for the sake of extending his protection. "The *vulcanized rubber*, as he writes in his amendment to his "specification, has many properties which peculiarly adapt it "to this use, and which, being absent in gutta-percha, he now "finds would render it unfit for such a use."

"I beg the office not to consider that, because gutta-percha "has been used before with artificial teeth, *that* Mr. Cum- "mings' invention is, therefore, the mere substitution of one "substance for another and a similar one; for such is not the "case.

"The *vulcanizing process makes all the difference*, requiring in- "vention and experiment, and *changes the article of manufacture* "*entirely*, making the palate elastic, which gutta-percha would "not, and rendering the whole article (so far as gums and "palates are concerned) capable of resisting heat and acids, "which gutta-percha will not.

"There is a similar case which was granted last year, and "which is perfectly parallel to the case now presented.

"A patent was granted to J. M. Batchelder, June 13, 1854,

" for covering telegraphic wires with *India-rubber*, &c., for in-
" sulating them, &c., when wires had been before covered with
" gutta-percha for the same purpose. With these views, and the
" suggestions contained in the amendments to the specn, now
" sent, I ask for a revision of the decision. I send herewith a
" more perfect specimen of a set of teeth, although the ma-
" terials are precisely similar to those of the sample at the
" office. I also send a certificate of a gentleman who has used
" a set for some time.

" Very resp., your ob. ser.,

" EZRA LINCOLN.

" Hon. S. T. SHUGERT,
" *Actg. Commiss. of Patents.*
" J. A. Cummings to Office. Filed 3d August, '55, 3,244–3."
(Record, pp. 166, 167.)

" To Hon. S. T. SHUGERT,
Acting Commissioner of Patents:

" Sir,—I hereby amend my specification, by striking out the
" words '*or some other elastic material*,' on the 27th and 28th
" lines of page 1, and substituting the word '*vulcanized*' for
" the word '*indurated*;' in the 28th line of the same page,
" also by striking out the words 'or of gutta-percha, *or in fact*
" '*of any elastic substance*,' in the 7th and 8th lines of the second
" page, and the words '*or other elastic material*,' on the 16th
" and 17th lines of page 2d; also by inserting at the close of
" the specification the following words, viz.: 'I am aware that
" ' gutta-percha has been used for artificial palates, but has
" ' been found to be totally inadequate to the purpose, as it
" ' becomes plastic when submitted to water below the boiling-
" ' temperature, and cannot, therefore, withstand the heat of
" ' the liquids which ordinarily are passed through the
" ' mouth; neither can it resist the action of the acids which
" ' come from the secretions about the same, and consequently
" ' its application to this purpose has long been abandoned as
" ' impracticable. My improvements in the manufacture of
" ' sets of artificial teeth, it will be observed, consists in com-
" ' bining them with *rubber, etc., which is vulcanized after the*
" ' *teeth are inserted therein. The vulcanized rubber* may be made
" ' nearly as hard as bone and yet retain some of its elasticity,
" ' and after being properly *vulcanized* it is unaffected by ex-
" ' posure to the air, to water, to organic acids, and uninflu-
" ' enced by any ordinary agents. It, therefore, possesses all
" ' the qualities which are desirable in artificial palates, which,
" ' as I have before stated, gutta-percha does not.'

" I also further amend my specification, by striking out the
" claim, and inserting in lieu thereof the following:

" I do not claim the use of gutta-percha, or any material
" which is *merely rendered plastic by heat and hardened by cool-*

" *ing*, in the manufacture of sets of artificial teeth ; but what I " do claim as my invention, and desire to have secured to me " by Letters Patent, is the improvement in the manufacture of " sets of mineral or other artificial teeth, which consists in " combining them with a *rubber palate* and gums, which (*after* " *the insertion of teeth*) are *vulcanized* by Goodyear's process, or " any other process, forming thereby a cheap, durable and " elastic substitute for the gold plates, &c., heretofore used.

" JOHN A. CUMMINGS,

" By his Atty., EZRA LINCOLN.

" Boston, July 30th, 1855."

(Record, p. 167.)

These amendments do not appear in the body of the specification when finally issued as printed in the record ; but the claim limited the invention sought to be secured to forming the plate and gums in which the teeth are inserted in one piece of hard rubber or vulcanite.

" Office to J. A. Cummings, 2 Oct., '55. 3,244–10.

BOSTON, Jan'y 17th, 1856.

" Dear Sir,—Herewith return the specification of John A. " Cummings' impr'v'ts in the manufacture of sets of artificial " teeth, having made a slight verbal amendment, the error in " which occurred in copying. I am requested by the appli- " cant in this case to make an appeal to the commissioner, and " would, therefore, request that all the papers may be laid be- " fore him.

" When the case was prepared, the *supposition* was that the " forming the plates and gums of *any plastic substance* in which, " *while plastic*, the teeth could be inserted and there held by " *the hardening of the same*, was new.

" The original specification, it will be seen, identified the " impr'v't suggested in the amended claim, viz., the impr'v't " in the manufacture of sets of artificial teeth, and notwith- " standing the prior use of gutta-percha in this manufacture, " I think will be admitted, on reading the *disclaimer and* " *amended claim*, that there is a *patentable distinction*.

" The gutta-percha has been abandoned because it would " not withstand the warmth of the secretions and the acids " about the mouth. The combination of the mineral or other " teeth with *India rubber* (*to be vulcanized after the teeth are in-* " *serted*) makes a new article of manufacture which is practica- " bly useful, and can be afforded at a much cheaper rate than " any sets of artificial teeth which can be used successfully.

" The question whether there is anything patentable in this

" case can be determined under this application, and the pre-
" amble could be altered to suit the amended claim.
" Hoping for a favorable issue in the case, I remain,
Very truly y'rs,
" E. LINCOLN.

" Hon. CHAS. MASON,
" *Commissioner of Patents.*
(Record, pp. 171, 172.)

" U. S. PATENT OFFICE,
" April 7th, 1864.

" Sir,—In the examination of your application for Letters
" Patent for a mode of securing artificial teeth to gum plates,
" it is found that the substance of your present claim is em-
" braced in an application filed by you in 1855, and rejected
" for want of novelty.

" It appears that a satisfactory reference was then given to
" the use of gutta-percha and a disclaimer to it made by you,
" while your present claim and specification is broad enough
" to cover it. Your claim was then confined to what was
" known as 'hard rubber,' now called 'vulcanite,' and al-
" though three times rejected, it does not appear that *this*
" *material* was ever before used for this purpose, the case of
" Stearn's vulcanized rubber plate and *velum*, to which you
" were then referred, having no bearing whatever upon your
" invention.

" In justice, therefore, to your rights as an inventor, the office
" will not object to the admission of a claim *limited to the use of*
" *this material for this purpose.* The specifications and draw-
" ings are herewith returned for amendments in particulars
" noted as defective, and a modification of the claim.

" JOHN A. CUMMINGS,
" Care
" A. POLLOK, Esq.,
" Present,
" 234.

" (Endorsed)—Office to J. A. Cummings, Apl. 7, '64.—C. G. P.
" —(18).—247.
(Record, p. 292.)

" WASHINGTON, April 12, 1864.

" I hereby amend my specification of improvements in arti-
" ficial palates and gums by inserting in the fourth line of the
" claim between the words 'of' and 'rubber,' the word
" 'hard.'

" And I also amend my said specification by erasing in the
" fourth line of the claim the word 'other,' and by substituting
" therefor the following' 'vulcanite' *i. e.*, an.'

" I also amend said specification by erasing in the fifth line " of the claim the words 'or material.' "

" JOHN A. CUMMINGS,
" By A. POLLOCK, his Att'y.

" Exd. S. F. S.

" Endorsed.) Amendment April 12, 1864.
Record 292.

The pertinency of this documentary proof, most of which the complainant itself has produced is supported by the decision of EMMONS, *J.*, in Mann *vs.* Bayliss, reported in *Chicago Legal News*, October 7, 1876, where it is said :

" His Honor said, while he did not assent to the argument " of the learned counsel for the defendant, that the complainant " was estopped by the declaration of his pleader in the Patent " Office, that this curvilinear receiver was old, and that there- " fore he did not claim it ; still, in cases of this character, " such a deliberate assertion was not without its influence. " He felt some relief, in denying this injunction, that he was " not compelled to go outside of complainant's own record for " a plain declaration that he was right in the construction of " this claim. He should be unwilling to have it thought the " concession in these papers constituted a very influential ele- " ment in the reasons which induced his judgment. But when " the whole history of this case was looked at, and it is re- " membered that this is a reissue, seeking to claim something " thought of originally only to be disclaimed, this matter may " well be mentioned as a provocation to pretty close scrutiny " of the extraordinary claim now insisted upon—one which " declares to every citizen that he shall not insist between a " novel device and an old one, to neither of which complainant " has any right, a thing so simple, so utterly destitute of every- " thing like invention as the oblique board or common 'chute,' " down which the grain falls upon the binding table, in the " case before us."

From what has already been stated, it is evident that both the inventor and the Patent Office understood the invention to be limited to the use of rubber—at all events, to the use of rubber and its allied vulcanizable gums, and the claim of the original patent was therefore so limited, though the language of the body of the specification was loose and inaccurate. When the patent was reissued, it was deemed highly proper, if not absolutely necessary, to remove all possible doubt on

the subject by excluding every word inconsistent with such limitation. This was effectually done. This circumstance, coupled with the language of both specifications and claims, especially the specification and claim of the reissue 1904, is equivalent to an express disclaimer of every set of teeth not made of a vulcanizable compound, and estops the complainant from demanding a different construction.

Byam *v.* Farr, 1 Curtis C. C., 260, 263.

Railway Co vs Sayles 97 U.S. 554
Leggett vs Avery 101 " 256

III.

The construction of the patent for which we now contend, is in perfect harmony with the description of the invention given by the complainant, through its intelligent expert, Mr. Henry B. Renwick, in the Smith case, a case which was made a test one by consent of both parties, and was elaborately prepared by both sides. His testimony is part of the Record in the present case.

On his examination-in-chief in that case he described the invention of Cummings as follows:

" *Int.* 18. State how the complete vulcanite dental plate, de-
" scribed in the Cummings reissue patent No. 1,904, differs in
" its process of manufacture, and the thing itself, when made,
" from dental plates made of gold or other metals, with teeth
" attached thereto?

" A. I have never worn artificial teeth of any kind, and can
" therefore answer the question only from my knowledge of
" vulcanite and its properties; also, of metals and their prop-
" erties, and from examination of sets of teeth made in various
" ways.

" Some twelve or thirteen years ago, I made for the India
" Rubber Comb Co. a long series of experiments upon vulcan-
" ite, and became tolerably familiar with the properties of that
" substance, and also of its behavior during the vulcanizing
" and first processes of manufacture. The *essentials of the pro-*
" *cess* for manufacturing the article of manufacture described
" in the Cummings patent are, first, that the teeth shall be
" partially embedded in the *vulcanizable compound* in its plaster
" or putty-like state, with a tight fit between the compound
" and the teeth, the teeth being properly arranged, and the
" compound being shaped into the form of the desired plate;

" second, *that the compound with the teeth in it should be vul-*
" *canized while the teeth are held in proper position in the*
" *compound.* The reissued patent describes *vulcanization* as
" being effected in plaster moulds, which hold the teeth in po-
" sition in the compound. I know of no process for forming
" sets of artificial teeth in which the essentials of the process
" described in the reissue are employed, nor is it suggested in
" any of the exhibits. It is true that those exhibits which re-
" late to sets of teeth mounted upon a tin base, do describe a
" method of forming plaster moulds with teeth stuck fast in
" one half of the mould, which is identical with the preparatory
" part of the process described in the reissue, namely, that
" which describes the preparation of a mould of plaster, with
" teeth stuck in it, the cavity of the mould being the counter-
" part of the desired plate. But this is the precise point at
" which the essentials of the process described in the patent
" commence."

Record, pp. 68, 69.

Mr. Renwick was confronted by a considerable number of inventions of earlier date than Cummings presented, both by complainant's and defendant's counsel during his examination in the Smith case, and the manner in which he distinguished them from that of Cumming's is exceedingly instructive. The following are some of the questions put to, and the answers made by him.

" Int. 3. Please state what you find to be the invention embraced therein?

" A. A new article of manufacture *consisting of a plate of hard*
" *rubber* or *vulcanite* with teeth, or teeth and gums secured
" thereto *in the manner described in the patent*, the whole making
" what is sometimes called a case, or, in ordinary language,
" a set of artificial teeth.

" Int. 4. Have you examined the Letters Patent of the
" United States, granted to Nelson Goodyear, dated May 6,
" 1851. No. 8,075, for improvement in manufacture of India
" rubber, and do you understand what is therein described.

" A. I have examined the patent referred to in the question
" some years ago, and lately a copy thereof in the printed record
" in this case, and I understand what is therein described.

" Int. 5. Please compare what is described in said Goodyear
" patent No. 8,075, with what is described in said Cummings
" reissue No. 1,904, and state whether you find described or
" suggested in said Goodyear patent the invention embraced
" in said Cummings reissue.

" A. The Goodyear patent of 1851 describes the compound
" now known as vulcanite and the method of *making it*. It does

"*not suggest or hint at the combination of that material with teeth* "in the manner described in the Cummings reissue, and does "not, *therefore*, describe the invention embraced in that re- "issue.

"Int. 6. Have you examined the English Letters Patent "granted to Alfred Vincent Newton, No. 13,542, enrolled the "fourth day of September, 1851, and dated March 11th, 1851, "and do you understand what is therein described? And if "yea, please compare what is described in said Newton pa- "tent with what is described in said Cummings reissue, and "state whether you find described and suggested in said New- "ton patent the invention embraced in said Cummings re- "issue?

"A. I have examined a copy of the Newton patent in the "printed record in this case. It contains a description sub- "stantially identical with that in the Goodyear patent before "referred to; also a description of how articles of vulcanite "that have been formed in moulds may be vulcanized out "of the moulds by pressing them in pulverized soap-stone, "sand, etc.; also a description of how iron may be covered "with vulcanite by wrapping the iron with a sheet of vulcani- "zable compound, and then binding it fast to the iron with "strips or ribbons of cloth, and finally vulcanizing the com- "pound, while it is surrounded by the strips or ribbons. I do "not find any suggestion in this patent of the article des- "cribed in the Cummings reissue; in fact, the description, if "read, would rather deter an inventor from experimenting to "produce such an article, as it would be impossible to *vulcan- "ize teeth imbedded with rubber so as to form a dental plate*, if the "teeth *and vulcanizable compound were secured together by strips "or ribbons of cloth during the process of vulcanization.*

"Int. 7. Have you examined the Letters Patent of the "United States, granted to John Allen, dated December 23, "1851, No. 8,721, for improvement in setting mineral teeth, "and do you understand what is therein described; and if yea, "compare the same with what is described in said Cummings "reissue, and state whether you find described or suggested "in said Allen patent the invention embraced in said Cum- "mings reissue?

"A. I have examined a copy of the Allen patent, printed in "the record in this case; it describes a method of making a "set of artificial teeth by using an ordinary metal plate, and "securing the teeth to the plate by means of a cement, which "is a sort of porcelain paste, which is applied to the teeth and "the metal plate, and afterwards *baked into porcelain*, the gums "being formed of the same porcelain paste which is converted "into porcelain at the *same baking*; in this way the inventor "states that the usual method of attaching teeth to a metal "plate is dispensed with, but that they may be attached in the

" usual way by means of a back plate; I have never seen a set " of teeth made in this way without the metallic back plate; " when made with the back plate, the article described is the " ordinary continuous gum set of teeth; I find in this patent " no suggestion or description of *either vulcanite itself* or of the " article of manufacture described in the Cummings reissue.

"Int. 8. Have you examined the English Letters Patent " granted to Edwin Thomas Truman, dated August 15th, 1848, " No. 12,241, for improvement in constructing and fixing arti- " ficial teeth and gums, &c., and do you understand what is " therein described; and if yea, compare the same with what " is described in said Cummings reissue, and state whether you " find suggested or described in said Truman patent the in- " vention embraced in said Cummings reissue?

"A. I have frequently and carefully examined a copy of the " Truman patent referred to in the question, which forms a " part of the printed record in this case; it is a patent for " making a case or set of teeth; in order to make such a set, a " skeleton plate is first prepared, furnished with proper pins, " upon which the teeth are to be cemented; this skeleton plate " or metal frame, the patent states, may be made of wire or " otherwise, and its purpose is to support the pin upon which " the artificial teeth are cemented; after this plate has been " made, it is to be enveloped in pure gutta-percha or wax, the " wax or gutta-percha surrounding the upper part of the teeth, " which are in place upon their pins, but not cemented thereto, " and the the gutta-percha or wax serving, as it were, as a " cushion, making the fit between the skeleton plate and the " alveolar ridge and roof of the mouth, if it be an upper set, and " also furnishing the artificial gums which appear outside and " at the top of artificial teeth; after the gutta-percha or wax " has been moulded around the metal frame or plate, the teeth " are pulled out, their pins attached to the frame are covered " with wax, and the wax or gutta-percha is gilded; the wax is " then removed from the pins, and the teeth are shoved into " their sockets and cemented on to the pins in the same man- " ner as when using gold plates; the patentee states that the " gilding can be dispensed with, but he nowhere states that the " cementing of the teeth fast to the metal frames or skeleton " plate can be dispensed with, and I know, from experiments " with gutta-percha and wax, that the teeth could not be held " for the purpose of mastication unless they were so cemented " to the frame; the great object of the patentee seems to have " been to obtain a set of teeth which would perfectly fit the " surface of the mouth and gums, and this fit is obtained by " surrounding a metal frame with wax or gutta percha; *I do* " *not find in this patent any description of vulcanite, any descrip-* " *tion of teeth attached to vulcanite in any way,* not even a sug-

" gestion of the article of manufacture which is described in " the Cummings reissue."

Record, pp. 61, 62, 63.

The printed description of Delabarre's process was presented to Mr. Renwick, by the complainants' counsel in order that he might distinguish it from that of Cummings. After an elaborate account of the manner in which Delabarre made his teeth, which certainly contained several of the features embraced in Cummings' alleged invention: the witness says " *This exhibit does not describe or refer to vulcanite.* It does not describe an article of manufacture in which *a vulcanizable compound is vulcanized in contact with teeth*, and does not suggest or embrace the invention described in the Cummings reissue."

Record, pp. 64, 65 and 66.

" Int. 13. Have you examined Defendant's Exhibit No. 41, " being an article from the *Lancet*, vol. 2, September 13th, " 1845, pages 284 to 287, and vol. 2, September 20th, 1845, " pages 210 to 212 (Record, 513 to 515), and do you understand " the same? And compare what is described in said article " with what is described in said Cummings reissue, No. 1,904, " and state whether you find described or suggested in said " article the invention embraced in said reissue?

" A. I have examined the article referred to in the question; " it describes experiments in making artificial palates, or parts " of palates, of India rubber, or soft, vulcanized India rubber, " *such as shoes are made of.* The palate referred to in this " description is, as I understand it, the organ which hangs in " front of the throat, and is not what dentists sometimes call " the palate, namely, the roof of the mouth, although I may " be mistaken on this point. *This exhibit does not even name* " *vulcanite, or sets of teeth mounted on vulcanite*, and does not " suggest or embrace the invention described in the Cummings " reissue."

Record, pp. 66 and 67.

" Int. 15. Examine Defendant's Exhibit No. 57, being an ar- " ticle from the *New York Dental Recorder*, volume 3d, No. " 4, January, 1849, page 80 (printed on page 562 of Record), " and state whether you understand the same, and compare " what is described therein with what is described in said " Cummings reissue, and state whether you find described or " suggested in said article the invention embraced in said re- " issue."

" A. I understand the exhibit. It is a statement that artificial palates may be made of gutta-percha or gutta-percha with a piece of *soft*, prepared rubber attached to it. The article contains a statement that the writer is ignorant of the length of time during which gutta-percha will resist the action of the fluids of the mouth, and hopes that his plan will be fully tested. Teeth mounted upon anything are not referred to in the exhibit; *neither is vulcanite or hard rubber.* The exhibit does not describe or suggest the invention embraced in the reissue of Cummings."

" Int. 16. Examine Defendant's Exhibit No. 62, being an article from the *New York Dental Recorder* for October, 1851, being an article signed 'A. Hill,' dated October 22, 1851, and compare what is described therein with what is described in said Cummings reissue, and state whether you find described or suggested in said article the invention embraced in the said reissue of Cummings.

" A. I do not understand the exhibit referred to in the question. It speaks of an *artificial compound* in which teeth may be set without the necessity of *backing or soldering in the ordinary way.* The article does not state *what the compound is*, and I *therefore* cannot compare the exhibit with what is described in Cummings reissue."

Record, p. 67.

The special attention of the court is here called to the article referred in the above interrogatory 16. We respectfully submit that the description of Hill embraces everything that is essential in Cummings' invention, except a compound specified as vulcanizable, or except vulcanization and vulcanite. The witness' answer concedes this by stating that he cannot tell whether it embraces Cummings' invention, because Hill does not state what his compound is.

" A NEW MODE OF SETTING ARTIFICIAL TEETH."

" The undersigned has invented and put in operation a plan by which artificial teeth may be mounted and secured in the mouth without the aid of metallic plates or springs of any kind. This device consists of an artificial compound substance (similar in its composition to " *Hill's Stopping,*") that can be easily moulded while in a plastic state over a plaster model of the mouth, and of a color resembling the natural gums. This substance can be moulded with perfect facility to any desired form, and soon becomes sufficiently firm and solid to hold the teeth in their places, and sustain them in the

" mouth. Being formed in its plastic state, it can be made to " fit any model in the most perfect manner, so that *even single* " teeth or *partial* sets are easily retained in the mouth without " the aid of ordinary springs or clasps, by means of atmospheric " pressure alone.

" The great ease and facility of working this substance en- " ables the operator to extend it in any direction, and to mould " it over the alveolar ridge in such a manner as to restore the " contour of the face, no matter to how great an extent ab- " sorption of the ridge may have taken place.

" It likewise obviates the necessity of gum-teeth altogether, " as a beautiful artificial gum may be easily formed of the sub- " stance itself.

" *The teeth are secured by moulding the compound around their* " *base*, without the necessity of backing or soldering in the " ordinary way, and are easily restored in case of accident, " without interfering with the rest. Entire or partial sets can " be made with equal facility, and worn with great ease and " comfort, as a *perfect* fit is readily obtained, and no sharp " cutting edges are felt to irritate and fret the parts.

" For *under* sets it cannot fail to commend itself, where " firmness and solidity are so desirable, because of its extreme " simplicity and convenience. For here the edges of the piece " that rest upon the muscles can be made just as obtuse or " round as the operator may desire and the circumstances of " the case admit, and the alveolar ridge built up to any desir- " able form.

" In short, this arrangement seems to us to reduce the dif- " ficult process of mounting artificial teeth, to the greatest pos- " sible degree of simplicity, and we are at a loss to conceive " how any mode *more simple or economical can possible be de-* " *vised.*

" We are now ready to anticipate some of the questions and " objections that will doubtless be started in the minds of our " readers.

" 1st. Is the compound firm enough to sustain the teeth in " mastication?

" We answer yes, abundantly so in most cases, and *especially* " so where circumstances will allow a considerable degree of " thickness over the alveolar border, and *almost every case* will " allow this.

" 2d. Will it withstand the fluids of the mouth?

" We answer, it will stand as well as 'Hill's Stopping,' and " *that* will stand where there is no friction from mastication. " But 'the proof of the pudding (as the old adage says) is in " eating it,' and *time alone* can test the durability of this ar- " rangement. We have several pieces that are now being " worn by our patients very successfully. One piece has been

" worn without the *least alteration* for more than six months,
" and that too under circumstances calculated to test it *severe-*
" *ly*, and is likely to last an indefinite length of time to come.
" For *temporary* sets we are *certain* they must succeed, and
" we have high hopes of something more, but time alone must
" settle this question.
" For several months *past* we have been experimenting with
" respect to a *gum color*, and have succeeded so well that we
" expect soon to offer it to the profession on such terms as
" may seem to us *just* and proper.
" Oct. 22, 1851.

" A. HILL."

Record, pp. 375, 376.

We are left in no doubt, after reading this article, as to why Mr. Renwick could institute no comparison between what is described by Hill and Cummings' invention. Hill described a plastic, but not a rubber compound. He moulded it around the teeth, but it was necessary to go further, and say whether he used rubber and vulcanized it, in order to settle the question whether he anticipated Cummings or not.

The witness' attention was then called to several other exhibits in the case, and speaking of two of them he stated as follows:

" Exhibits 55 and 56 describe sets of teeth in which the
" plates are made wholly of tin, or of tin loaded upon a gold
" plate, to which the teeth have been soldered by means of
" the usual backing. These sets, when finished, are substan-
" tially the same as those described in Exhibits 38 and 40.
" I understand what is described in each of these exhibits.
" *They do not describe vulcanite or hard rubber*, and do not de-
" scribe or suggest the invention embraced in the Cummings
" reissue."

Record, p. 68.

Thus far on the examination of Mr. Renwick in chief. The following appears on his cross-examination in the same case:

" Cross-Int. 20. What do you mean by the words 'in the
" manner described,' as used by you in answer to question No.
" 3?
" A. I mean that the teeth are to be partially surrounded
" by the vulcanite in such manner that a tight joint is made
" between the vulcanite and the teeth, and that the teeth are
" secured by pins, which are imbedded in the vulcanite.
" Cross-Int. 21. Is that all that is comprised in the words

" 'in the manner described,' as used by you in your answer to " question No. 3?

" A. Yes; but it may be proper to state that *I know of no* " *way in which the teeth can be secured in the manner described* " *except by placing them in the vulcanizable compound*, or placing " the vulcanizable compound around the teeth and pins while " the compound is in a putty-like state, before it is cured or " vulcanized.

" Cross-Int. 22. Then you find the invention embraced in " the Cummings reissue No. 1,904 to be a new article of man- " ufacture, consisting *of a plate of hard rubber or vulcanite, with* " *teeth*, or teeth and gums secured thereto, the teeth being par- " tially *surrounded by the vulcanite*, in such a manner that a " tight joint is made between the vulcanite and the teeth, and " that the teeth are secured by pins which are imbedded in " the vulcanite, the whole making a case or set of artificial " teeth; is not that your definition?

" A. Yes.

" Cross-Int. 23. Then, if this defendant has not made his " rubber or vulcanite plates and secured the teeth, or teeth " and gums, thereto in the manner described in said patent, as " you have just defined such manner, have the plates made by " him contained the invention which you find embraced in the " Cummings reissue, No. 1,904?

" A. *I do not understand that the manner in which the defendant* " *made the plates affects the question;* the question *with me would* " *be, what the plate was after it was made;* if the plate after it " it is made is not substantially like that described in the " Cummings reissue, it does not contain the invention specified " therein; I have never seen one of the defendant's plates."

Record, pp. 71, 72.

" Cross-Int. 29. If the rubber or other material is first " moulded to fit the shape of the mouth, and the gums formed, " and while soft and pliable the teeth are imbedded in the " gums, and, as an additional security, fastened to the same by " small pins, and the teeth, gums and plates thus connected, " then baked until the elastic material becomes sufficiently " vulcanized, does such plate so made contain the invention " which you find embraced in the Cummings reissue, No. " 1,904?

" A. As I understand the question, it does not define the " material *of which the completed plate is made as vulcanite*; the " question *speaks of an elastic material before it is vulcanized;* the " compound of rubber and sulphur before vulcanization is not " elastic; it is like putty; in order to get a Cummings set of " teeth, you must first have A VULCANIZABLE COMPOUND OF GUM " and sulphur, *and finally vulcanite*; I cannot answer the ques- " tion as propounded; it is too indefinite.

" Cross-Int. 30. Can you not understand from the last " question that the material is vulcanized?

" A. I cannot; because the first part of the question speaks " of other material, and the last part of it talks of vulcanizing " an elastic material.

" Cross-Int. 31. Can you not understand from cross-inter- " rogatory No. 29 that the material used is vulcanizable?

" A. No, I cannot; because I know of *no vulcanizable* " *material but india-rubber and allied gums*, and *I know of no* " *vulcanite which is procured by baking an elastic material.*

" Cross-Int. 32. Assume the material used to be a vulcan- " izable compound of rubber and sulphur, and answer cross- " interrogatory 29 upon that assumption?

" A. *If the material is a vulcanizable compound of rubber and* " *sulphur, and in proper proportions to make vulcanite*, and it is " formed *while soft into the shape of a plate*, and the teeth are " then imbedded in it with pins as an additional security, *and* " *the teeth and plate are then subjected to heat, so as to vulcanize the* " *compound, then* the article produced would be the article de- " scribed in the Cummings reissue, the assumption, of course, " being that the article, when produced, has the teeth in the " proper place."

Record, pp. 73, 74.

" Cross-Int. 35. If a case or set of teeth is made by securing " the teeth to a wire frame bent into a shape approximating " that of the mouth, and then covering this frame with the " rubber compound, so as to form the plate and gums, and then " vulcanizing them, does such case so made contain the inven- " tion embraced in the Cummings reissue, No. 1,904?

" A. If I understand you rightly, the plastic compound is to " partially surround the teeth so that they will be embedded " in it, and also to partially or wholly surround the wires at- " tached to the teeth, and *that the compound is then to be vul-* " *canized in contact* with the teeth and wires. A set so made " would, so far as I can judge, be the Cummings article of " manufacture. It would differ in degree and form from " Cummings' in having long, and uselessly long, wires or " pins.

" Cross-Int. 36. As you understand it, does any change take " place in the nature of the teeth themselves from the process " of vulcanizing the plate with which they are connected?

" A. No.

" Cross-Int. 37. In your opinion, would gutta-percha com- " pounded with sulphur, or with sulphur or other ingredients, " in the manner described in the patent of Nelson Goodyear, " No. 8,075, dated May 6, 1851, for making hard rubber, and " subjected to sufficient heat to vulcanize it, be the equiva- " lent of the vulcanite described in the Cummings reissue, " No. 1,904?

" A. I do not find gutta-percha mentioned in the Goodyear " patent, referred to in the question. *Gutta-percha mixed with* " *sulphur in proper proportions and then vulcanized, would be the* " EQUIVALENT of the vulcanite described in the Cummings re- " issue. It would be, as far as my experience leads me to " judge, an inferior equivalent.

Record, p. 74.

We are well aware that the testimony of an expert cannot conclude the court on a question of construction. It is not his province to construe the patent, but the character of the invention described is a question of *fact* upon which his testimony is properly taken. On that question, he puts forth the claim of the patentee or owner of the patent, as to what the essential qualities or features of the invention are. Mr. H. B. Renwick, the witness, is intelligent, and was thoroughly conversant with the state of the art and the invention of Cummings. On the points of his testimony which we have cited, he was not contradicted in any essential particular, and Judge SHEPLEY agreed substantially with Mr. Renwick. This Court has affirmed Judge SHEPLEY. That Mr. Renwick, when he gave this testimony, clearly understood that rubber, vulcanization and the result, vulcanite, were essential and indispensable elements in the invention, is too apparent to require argument or comment.

IV.

It is now in order to examine the description of the Cummings invention, and the construction given to the patent by the courts in suits which have preceded the one now to be determined. Under this head we shall confine ourselves to the decisions rendered in the First Circuit, one made in the Southern District of New York, and the opinion of this court in the Smith case. These are the only ones in which the construction of the patent underwent an independent examination, for, in the other districts and circuits, the decisions followed those which have been made in the first circuit. We will consider the latter in their chronological order.

1. THE WETHERBEE CASE, 2 CLIFFORD, 555.

On pp. 564, 565, 566, Mr. Justice Clifford, after disposing of other important questions, says:

"Coming to the merits of this case, it becomes necessary to "ascertain the character of this invention, and the true con- "struction of the patent. Present suit is founded on the "second reissued patent. Claim of the patent is: 'The plate "'of hard rubber or vulcanite, or its equivalent, for holding "'artificial teeth, or teeth and gums, substantially as de- "'scribed.' The invention is designated in the patent as a "new and useful improvement in artificial gums and palates, "but it is described in the beginning of the specification as a "new and useful improvement in plates for artificial teeth, "which, perhaps, is the better general description; adopting "the usual order, the inventor, in the first place, points out "the objections to, and inconveniences in the old mode of "attaching artificial teeth to a metallic plate, and of fitting the "same to the roof of the mouth. They are, as stated, that "the metal was expensive, and that the plate being hard and "unyielding was apt to injure the mouth, and that its tend- "ency was to impede mastication and obstruct articulation. "He then proceeds to say that his *invention* consists in form- "ing the plate to which the teeth, or teeth and gums are "attached, *of hard rubber or vulcanite* so called, and describes "the hard rubber or vulcanite as an elastic material, possess- "ing and retaining, when used in that way, sufficient rigidity "for the purposes of mastication, and being pliable enough at "the same time, to yield a little to the motions of the mouth. "Description is then given of the manner of making the *hard* "*rubber plates*, from which it appears that impressions are "taken of the mouth, or that part of it the plate is to fit, of "wax or plaster, in the same manner as is usually practiced "in the construction of gold plates for artificial teeth. Super- "added to that is also a description of the means employed "in setting and securing the teeth, or also of the kinds of "teeth which may be employed. They are set in place and "adjusted to the proper distance and fulness in the same "manner as practiced in setting teeth in gold plates. But "they are provided with pins projecting in such a manner, "that the rubber will close around them and hold them secure "in position. When completed, the plaster mould, with the "teeth set as described, is carefully filled with *soft rubber*, and "the same is made secure in its position, by placing another "plaster mould over it, and while in that position is *heated or* "*baked* in an oven or some other suitable way. The state- "ment of the patentee is, that the soft rubber or gum is to be "compounded with sulphur, &c., in the manner prescribed in "the hard rubber patent, and is to be subjected to sufficient

" heat to *vulcanize or harden it*, as directed in that patent. " * * * * * After the plate has been heated or " baked sufficiently to convert it into *hard rubber*, the mould is " removed, and the plate is then polished for use. The *claim* " *of the patent conforms to the description* of the invention as " given in the specifications, *and it is not perceived that any* " *form of words can render it more definite.*" (In this case infringement was admitted.)

We respectfully submit that in this description of the invention and construction of the patent, rubber and vulcanization enter as essential elements—elements, in the absence of which, there is no mode of making a plate or set of teeth resembling Cummings', even suggested.

2. THE GARDNER CASE (3 Cliff., p. 408).— In this case the description of the invention and the construction of the patent, as given in that of Wetherbee, are repeated and emphasized.

On p. 410 Mr. Justice CLIFFORD remarks :

" Construed as the patent was by the court in the former " case, it is hardly denied that the described improvement was " patentable ; but the argument now is that the Letters Pa- " tent do not cover the process for making 'the plate for hold- " 'ing artificial teeth, or teeth and gums ;' that it covers 'noth- " 'ing but the use of hard rubber in making plates for artificial " 'teeth,' which, it is insisted, is not patentable, as the qualities " of the material were known to all the world, and that the " suggestion that it could be applied to such a purpose was " not a discovery or invention within the meaning of the patent " law. Had the claim of the patent been such as is supposed " in the proposition, there would, perhaps, be some foundation " for the argument ; but the proposition is founded on a mis- " taken view of what is claimed by the patentee in the second " reissue.

" The claim of the patent is 'the plate of hard rubber or " 'vulcanite, or its equivalent, for holding artificial teeth, or " 'teeth and gums, substantially as described.' As designated " in the patent, the invention is a new and useful improvement " in artificial gums ; but it is described in the beginning of the " specifications as a new and useful improvement in plates for " artificial teeth, which, perhaps, is the better general descrip- " tion.

" Taken literally, the claim is for the product as manufac- " tured ; but when the introductory words are considered in " connection with the words 'substantially as described,' it is " clear that it includes not only the *plate* of *hard rubber* for

" holding artificial teeth, or teeth and gums, but the process " or mode by which they are constructed."

* * * * * * *

" Special reference is made by the inventor, in the first " place, to the objections and inconveniences observable in the " old mode of attaching artificial teeth to a metallic plate, and " fitting the same to the roof of the mouth. They were, as " stated in the specifications, that the metal was expensive; " that the plate, being hard and unyielding, was apt to injure " the mouth, and that its tendency was to impede mastication, " and obstruct articulation. He then describes the *hard rubber* " which he uses for that purpose, characterizing it as an " elastic material, possessing and retaining, when used for that " purpose, sufficient rigidity for purposes of mastication, and " yet pliable enough to yield a little to the motion of the " mouth.

" His *invention*, as he states, consists in forming the plate to " which the teeth, or teeth and gums are attached, of *hard rub-* " *ber or vulcanite ;* but he proceeds at once to give a description " of the manner of making the *hard rubber plates*, from which " it appears that impressions are taken of the mouth, or that " part of it that the plate is to fit, of wax or plaster, in the " same manner as is usually practiced in the construction " of gold plates for artificial teeth. Superadded to that " is also a description of the means employed in setting " and securing the teeth, as also of the kinds of teeth " which may be employed. They are provided with pins pro- " jecting in such a manner that the rubber will close around " them and hold them secure in position. Minute description " is also given of the manner in which they are set in place, " and adjusted to the proper distance and fulness; and when " completed, the statement is that the plaster mould, with the " teeth set as described, is carefully filled with *soft rubber*, and " the same is made secure in its position by placing another " plaster mould over it, and while in that condition it is *heated* " *and baked* in an oven, or in some other suitable way."

* * * * * * *

"Neither party necessarily manufactures the hard rubber of " which the plate is composed, and in which the teeth are set, " any more than they do the artificial teeth. Both use arti- " ficial teeth, but they take such as they find for sale, and it " makes no difference whether the artificial teeth they use are " alike or different, and they both use *hard rubber* as they find " it, combined and prepared, or partially prepared, by third " persons, and they use *it* as a substitute for gold or *other* " *substances*, in forming the plate used for holding the teeth in " position as adjusted in the mould.

" *Hard rubber*, before it is *heated or baked*, is an elastic

" [plastic] compound, capable of being moulded like plaster " or wax, and *it* is used in that state to fill the plaster mould, " in which the teeth are set and adjusted, to hold the teeth in " position. Before the teeth are set and adjusted to the plate, " they are provided with pins, so that the soft rubber used to " fill the mould will close around them and hold them secure, " and while in that condition, the rubber is *heated, or baked,* " and becomes *hard,* as seen in practical use. Heat thus ap- " plied, if sufficiently intense, *vulcanizes or hardens the material,* " *and converts the compound into hard rubber.*

* * * * * * * * *

" When the plate has been *heated or baked sufficiently to con-* " *vert the material into hard rubber,* the mould is then removed, " and the plate is then polished for use. * * * *

" Rubber, such as the complainants use, is compounded " with sulphur, etc., in the manner described in the hard rub- " ber patent, but the rubber used by the respondent is com- " pounded, as he contends, with iodine without sulphur, and " under a different patent. Suppose the fact to be as he con- " tends, still it appears that *he uses rubber for plates as a substi-* " *tute for metallic plates,* and that he employs the same " mechanical means in forming the plate, and for setting and " adjusting the teeth, and for securing them in position, as the " complainants do, *and he also employs heat to harden the rubber* " *and fit the product for practical use, as a substitute for natural* " *teeth.*"

We shall have occasion to refer to this careful language of Mr. Justice Clifford hereafter, but we now call attention to the fact that he clearly includes rubber as a material, and vulcanization by heat (the only way vulcanization can be accomplished), as essential and indispensable elements in the invention of Cummings. In this case infringement was denied, and the learned judge was dealing with that question. Is it to be said that when he states, among other things, that the defendant infringed because " he uses rubber for plates as a substitute for metallic plates," and that " he also employs heat to harden the rubber and fit the product for practical use, etc.; " that he used words without meaning, and which are now to be ignored? It is true that he couples with these words the further statement that " he employs the same mechanical means in forming the plate, and for setting and adjusting the teeth and securing them in position, as the complainants do; " but where is the evidence, taking the whole sentence together, or considering that part of the opinion which precedes this pas-

sage, that the learned judge laid any more stress on the "mechanical means" than he did on the material and the manner in which that material was worked in connection with and into a dental plate or set of teeth?

3.—THE SMITH CASE (1 Holmes R., p. 354; 3 Otto, 486.) In this elaborately prepared, and thoroughly contested case, in which the state of the art, and the skill and learning of counsel were exhausted, his Honor Judge Shepley, reviewed the two preceding opinions, and gave his understanding of them, embodying his own views in an elaborate description of the invention and construction of the patent. To the able opinion in that case, we now recall the attention of the court.

On pp. 354–355 of his Honor's opinion, he says:

"The claim in the patent is for 'The plate of the hard rub-
" 'ber or vulcanite, or its equivalent, for holding artificial teeth,
" 'or teeth and gums, substantially as described.' This claim
" of the patent has been construed in this circuit in the cases
" of Dental Vulcanite Company *v.* Weatherbee, 2 Cliff, 555,
" and the same *v.* Benoni E Gardner. The substance and
" effect and determination of the court in these cases is, that
" the invention claimed was the described product and manu-
" facture by the means described in the specification. Adopt-
" ing the construction given in those cases to the claim in the
" patent, I know of no better description to be given to the
" invention patented to John A. Cummings and reissued to
" the complainant than this, that it is for a new article of manu-
" facture consisting of a *plate of hard rubber or vulcanite* with teeth,
" or teeth and gums secured thereto in the manner described
" in the patent. The patent is not for a process or art, but for
" the new product resulting from the manipulation by the de-
" scribed new process. It is one of those products, as will be
" seen by examination of the specifications describing the pro-
" cess of manufacture, in which the process so inheres that the
" described product can only be made by the described pro-
" cess. The patent is not for a dental plate of hard rubber
" *alone;* it is not for the substitution of the old material, vul-
" canite, in place of the gold and *other materials* which have
" been before used in the same way; it is not, as claimed by
" the defendant, for a dental plate of hard rubber vulcanized
" in moulds in the manner described in the patent; but it is
" for a set of artificial teeth as a new article of manufacture,
" *consisting of hard rubber or vulcanite,* with teeth, or teeth and
" gums, secured thereto in the manner described in the patent,
" by imbedding the teeth and pins in the *vulcanized compound*
" so that it shall surround the teeth and pins while the com-

" pound is in a soft state, before it is *vulcanized*, so that when " the compound is vulcanized the teeth are firmly secured by " the pins imbedded in the *vulcanite*, and there is a tight joint " between the vulcanite and the teeth. This manufacture was " a new manufacture ; new as to the thing made, new as to " the process of making it, *considering that process as a whole.* " The invention is not like that of a machine, but is one which " the process by which it is made is part of the substance of " the thing made, and a *characteristic feature* of its construc- " tion."

His Honor then proceeds to say, that it is evident from the description in the caveat of Cummings, filed May 18th, 1852—

" That he fully appreciated the fact that the importance " of his invention consisted *not* merely in the substitution of a " material rigid enough for the purposes of mastication and " pliable enough to yield a little to the mouth in place of the " 'hard, unyielding' metals previously used, and not merely in " the substitution of a material light and inxpensive, in place " of the heavy materials before used for the plate, but also in " the additional fact that by this improvement the teeth can " be easily *baked* into the gums which form one piece with the " plate. This statement, at that early period, sufficiently sug- " gests that he fully appreciated the advantages of the mate- " rial he used," etc.

* * * * * * *

And again, on p. 358, his Honor says :

" The claim of the defendant is that, in the reissue No. " 1,904, a new process in forming the plate is substituted for " the one described in the original patent ; and that the new " process described was not suggested or indicated in the " original patent. To properly determine this question we " must carefully examine the two specifications to *ascertain* " *what steps* in the described process are claimed as new as " distinguished from those steps in the process which were " old. The plaster moulds or *the manner of using them are not* " *described or claimed as new.* What is described and claimed " as new in the process is, in substance, *the making of a vul-* " *canite dental plate* out of a *vulcanizable rubber compound*, into " which the teeth are imbedded, in its plastic condition, and " the rubber compound, with the teeth imbedded in it, after- " wards *vulcanized* by heat, so that the teeth, gums and plate " should possess the *qualities* of *hard rubber or vulcanite.* All " that is involved in this statement is clearly indicated in the " original patent."

And again, p. 359:

"It is insisted in the argument that Cummings did not, in "his original application, describe a *vulcanizable compound*, be- "cause, he says, 'the teeth, gums and plate are then baked "'until the rubber or other elastic material becomes sufficiently "vulcanized.' This description, it is contended, does not "apply to vulcanite, because the soft rubber is not elastic be- "fore vulcanization. But, when we take the whole descrip- "tion, it is plain that he does not intend by the expression "'other elastic material' to apply it to a rubber in its soft "plastic or putty-like condition, but to a material which may "be an elastic material before its reduction to the soft condi- "tion or after its vulcanization. This meaning, however im- "perfectly expressed, is easily gathered from the whole de- "scription, *which plainly designates the material to be used as* "*rubber*, and the compounds commonly employed therewith, "reduced to a soft, plastic condition, *capable of vulcanization*, "*and subsequently vulcanized.*"

The opinion of this court, delivered by Mr. Justice Strong (3 Otto, p. 486), affirming the judgment of Judge Shepley, gives the same construction to the Cummings patent that had been given by the court below. It is, therefore, not necessary to cite it at length here.

Now, it is clearly stated, in these opinions, that the patent is not for a new article of manufacture, pure and simple, having a certain form and certain mechanical qualities, such as hardness, elasticity, impenetrability to fluids, etc., but a new manufacture, consisting of a dental vulcanite plate and set of teeth produced by a certain process, which process inheres in and characterizes the product—a process which, considered as a whole, is new, and without which the product, viz.: "the plate of hard rubber or vulcanite * * for holding artificial teeth, or teeth and gums, substantially as described," cannot be produced. This construction was inevitable if the patent was to be sustained. A patent for the product, pure and simple, viz.: a vulcanite plate and set of teeth, would be open to the objection that it was merely the application of an old and well known material to a new use. The process is, therefore, considered as an inseparable and integral part of the product, and the two, thus merged into a unit, the latter is held to be novel, and, therefore, secured to the inventor by the patent. It is pertinent to consider here what this process is, which comprises a vital part of this alleged invention, and

gives it life and being in the eye of the law. It consists of several successive steps, all of which must be taken in their prescribed order, before the product can be produced.

1. A cast of the mouth is taken in the usual way.

2. The plaster moulds are prepared in the usual way, and the teeth are so adjusted that they adhere in and form part of the mould, with small pins projecting from the teeth.

3. Soft rubber (compounded with sulphur, after the patent of Goodyear, for making hard rubber) is then put into the mould, a little at a time, pressed in with the finger, or some other convenient way, care being taken that the rubber is made to completely fit into the cavities and around the protuberances, including the pins, and is filled into the thickness or depth desired to form the plate.

4. The rubber plate is locked in position by shutting the other half of the mould over it to insure its retaining its exact form while warming.

5. The soft material, thus held in the mould, is subjected to heat sufficiently intense, and for a time sufficiently long, to produce that radical change in the character of the material known as vulcanization.

There is not a step in this process that can be omitted, and the product be produced. Fill the mould with any other material than rubber, and the process, considered as a whole, disappears. Fill the mould with rubber, and omit the step of complete vulcanization, and you have nothing fit for use. You may have a dental set in *form*, but it is soft as putty, and utterly worthless. By taking both these steps in the process, viz.: filling the mould with soft rubber, and then vulcanizing, you can alone produce the patented product. Both these steps must be taken before you can produce the product, pure and simple, or anything resembling it. Both these steps must be taken before you can produce the *described* product by the described process, viz.: "The plate of hard rubber or vulcanite

* * for holding artificial teeth, or teeth and gums, substantially as described." Well does his Honor Judge SHEPLEY, when describing the patented product, say: "*It is one of those* "*products, as will be seen by examination of the specifications de-* "*scribing the process of manufacture, in which the process so in-* "*heres, that the described product can only be made by the des-* "*cribed process.*"

It would seem that these opinions had definitely settled the construction of this Cummings patent and defined the rights of the complainant under it. But the latter having up to the commencement of this suit enjoyed the benefits of this construction, now seeks to repudiate it and substitute an entirely different one, viz., that the patent is *not* for a plate of hard rubber or vulcanite for holding artificial teeth, or teeth and gums, substantially as described, *not* for the described product produced by the described process, but the patent is for a dental plate made of any soft material afterwards hardened—for a plate of celluloid, compounded of vegetable fibre and camphor, produced by a different process, considering that process as a whole," a product in which the process of making a vulcanite plate does not inhere, the *essential* steps of that process being wholly discarded.

We do not understand that there is any conflict between the opinions in the Weatherbee and Gardner cases, and that in the Smith case. The latter is more minute and elaborate in its description of the invention and construction of the patent. All three of these opinions have had a wide circulation, especially the latter, which has been considered in other circuits as settling the construction of the patent, and has been repeatedly adopted and followed.

The Smith case, as heretofore remarked, has been affirmed in this Court.

V.

At this point in the scientific and judicial history of this patent the present struggle commences. A substantially new material, known by the trade name of celluloid, was discovered

and patented. It could be, and is, applied to many useful purposes in the arts, and, among other things, to the manufacture of dental plates or sets of teeth. Its ingredients embraced neither rubber nor sulphur. It was neither vulcanite nor capable of being made vulcanite. It was in no sense a vulcanizable compound. It was compounded of vegetable fibre, called cellulose or gun cotton, and camphor. Neither of these was a vulcanizing agent. When compounded, the product, celluloid, was not soft, but hard. The camphor was not only not a vulcanizing agent, but, on the contrary, performed an exactly opposite function, viz., it caused the compounded mass not to harden, but to soften under the action of heat. It was wholly different from and out of the range of rubber and all its allied gums—out of the range of all vulcanizable compounds. In manufacturing dental plates or sets of teeth, it was worked by a process wholly different from that which essentially characterized the manufacture of hard rubber or vulcanite plates, or sets of teeth. It was simply put into the old and well known mould—not in a soft, plastic or putty-like state, but in a hard, rigid condition like bone. It was then subjected to heat, not to vulcanize or harden, but to soften it. The mould was then gradually screwed down, and when its jaws were brought together the work was done. When its original temperature was recovered it was the same hard bone or horn-like substance as it was before being put into the mould; it was then ready to be polished fit for use. It was obviously a different article of manufacture from "the plate of hard rubber or vulcanite, * "* for holding artificial teeth, or teeth and gums substan- "tially as described," alleged to have been invented by John A. Cummings, and secured by the patent owned by this complainant. But, as an article of manufacture, this celluloid set of teeth could be put to the *same use* as that manufactured by the complainant, and therefore, commercially, came in competition with it. The complainant has now undertaken to suppress this competition, under the pretense that a celluloid set of teeth was a hard rubber or vulcanite set, within the meaning of the Cummings patent.

Confronted with the character of that patent as set forth in the specifications so clearly that, in the language, of Mr. Justice Clifford in the Weatherbee case, "it is not perceived that any form of words can render it more definite"—with the elabo-

rate description given of the character of the invention by the complainant's leading witness—with both the description of the invention, and the construction of the patent earnestly and successfully pressed on the courts in former cases, by able and thoroughly informed counsel speaking in behalf of the complainant—and by elaborate, fully considered, and solemn adjudications, the complainant found that its patent did not cover the whole field of the dental art. A new competitor had appeared with a dental plate made of an entirely different material from rubber, neither vulcanite or a vulcanizable compound. This competitor the complainant was anxious to suppress. In this emergency it again called upon Mr. H. B. Renwick. He does not appear to have responded to the call with his usual alacrity. He seems rather to have retired to ruminate for a while, as appears by the following from his cross-examination in the present case.

" Cross-Q. 12. Was not your testimony in the Smith case " based upon an understanding of the Cummings patent, re- " issue No. 1,904, being only for a case or set of teeth, the base " or plate of which was made of a vulcanizable compound, con- " verted by the Goodyear process into vulcanite ?

" A. I cannot say that it was ; I noticed the word equivalent " in the claims of the patent, but in studying the case before " testifying, dismissed the word from consideration as far as " the Smith case was concerned, because in that case the thing " sued was admitted to be a vulcanite plate ; after that time " my opinion was requested as to whether a case formed in " part of rose pearl or celluloid would be an infringement of " the patent ; *and after considering the thing carefully for some " days I came to the conclusion that it was.*"

Record, p. 57.

How many days Mr. Renwick was engaged in the mental struggle through which he reached the conclusion that he would attempt to demolish the elaborate description of the invention which he had given, and in the approval of which, by his Honor Judge Shepley, he had taken a just pride, does not appear, but he was thus painfully employed for some days at least. At last he came to the conclusion that his former description of the invention was erroneous, and that a new one was necessary in order to meet the new emergency.

But the witness has stated his reasons at length for what we insist is an entirely novel description of Cummings' inven-

tion, and to these we now call attention, premising that he is the only witness called by the complainant to this point. On his examination-in-chief (Record, pp. 53, 54), he sets forth these reasons as follows:

"I do not consider that Cummings' invention is dependent "upon the chemical composition of the plate, any more than "it depends upon the chemical composition of the artificial "teeth; it is only necessary, in order to apply his invention, "that teeth should be used possessing substantially the phys- "ical characteristics of artificial teeth, and that they should "be imbedded in a plate possessing substantially the charac- "teristics of a vulcanite plate for the purpose for which it is to "be used; *the physical characteristics of the substance which "forms the plate, in order to fit it for holding artificial teeth, in "substantially the manner described in Cummings' patent, are: "first, capability of being formed or moulded around the roots of "the teeth and pins while in a soft and plastic condition; and "second, strength and elasticity when cold and hard, such as is "possessed by whalebone, ivory, vulcanite and solid collodion, so "that it shall be sufficiently strong and rigid for the purpose of "mastication, and at the same time elastic enough to yield slightly "to the pressure of the jaw;* the process described in the patents "referred to in the question, as being practiced with celluloid "and teeth, must necessarily result in an article of manufac- "ture containing all the features that constitute, as before "stated, the distinguishing characteristics of the vulcanite "dental plate; I have examined many vulcanite dental plates, "and a considerable number of solid collodion or 'celluloid' "dental plates, and after looking at and handling them, was "unable to decide which were vulcanite and which celluloid; "in fact I picked out, in several instances celluloid as vul- "canite, and vulcanite as celluloid; I then compared those "composed of the one material with those composed of the "other, and could distinguish no difference in their physical "characteristics, except in their odor, and the slight trans- "lucency possessed by solid collodion or celluloid, not "deeply colored; the celluloid dental plate, made as re- "ferred to in the question, is in my opinion substantially the "the article of manufacture described and claimed in the Cum- "mings reissue; the celluloid and the vulcanite plates both "have the teeth supported by imbedding; both have a close joint "between the teeth and the substance which supports them; "both have sufficient strength, rigidity and elasticity; both of "them, as I am informed and believe, are unaffected by the "fluids of the mouth, and usual foods and condiments; and "both of them, by reason of being manufactured by moulding "and pressure, without use of metal dies, and therefore with- "out danger of alteration of such dies during stamping, are

" almost, if not quite, exact fits to the mouth and alveolar " ridge; I am also informed that users cannot distinguish, " when in use, sets of teeth made of vulcanite from those made " of celluloid; I am of the opinion previously expressed as to " the substantial identity of the two articles, although I know " that celluloid is a different chemical compound from vul- " canite, because I believe that the substantial resemblance " must be sought in those points or characteristics which are " brought into play in actual use, and not in characteristics " which are unimportant in such use. In further support of " this opinion, I state that solid collodion was described before " the date of the Cummings reissue as a substance which " might be used in many manufactures where vulcanite had " been used, and that I have seen it myself (although I cannot " state that it was before the date of the Cummings patent), " used for knife handles and cheap jewelry, as vulcanite was " and is used. I further state that solid collodion, prior to " the date of the Cummings patent, was obtained by evaporat- " ing out the solvent, and that such solvents were liquid " solvents, such as ether; and that I have examined patents " dated before the date of the Cummings patent which des- " cribe the mixture of camphor and other gums with col- " lodion.

" Q. 5. Do you understand that celluloid is compounded " with sulphur, rubber, etc., in the way sulphur and rub- " ber are usually compounded, or is subjected to heat to " harden it?

" A. I do not understand that celluloid is compounded with " sulphur, or has any sulphur in it; I understand that cellu- " loid is subjected to heat while in moulds to soften it, and " make it fit the teeth perfectly by pressure, as the vulcaniz- " able compound is, and that celluloid is hard when cold, " hardening during the cooling. A vulcanizable compound " becomes of a tarry consistency while subjected to heat in " the mould, and is hard when cold, after being subjected to " the heat, but I do not know when it commences to harden, " whether during the cooling or while at the highest heat; al- " though I do know that the final hardening takes place during " the cooling."

In the passage of the preceding extract in italics, the witness explains his new theory of the invention of Cummings. But we respectfully submit that he fails to comprehend the *patentable* characteristics of the invention, and the legal functions of a patent. What he calls " the physical characteristics " of Cummings' invention, viz., capability of being moulded, &c., and, " strength and elasticity, &c.," are not

patentable attributes of Cummings' plate, originating in the brain of Cummings. They are objects to be attained in making any and every set of teeth, and relate only to the question of *utility* or excellence. These objects were open to all dentists, whether inventors or not. Cummings could no more patent capability of being moulded, or elasticity, or rigidity, than he could patent form or color, nor has he attempted to do so. If he had, the claim of the patent would read, "What "I claim and desire to secure by Letters Patent is—a dental "plate made of any material capable of being moulded and "then hardened, and being sufficiently elastic to yield a little "to the motions of the mouth, and sufficiently strong and "rigid for the purposes of mastication." That would be a patent for a dental plate or set of teeth, pure and simple, without regard to the manner in which it was made, or the material out of which it was constructed, provided that it be a material that could be moulded and hardened and thus made useful. This is not Cummings' patent. By a recurrence to the original specification of Cummings, and the present re-issue in connection with the correspondence with the office, it will be seen that Cummings disclaimed "*other plastic materials*," and when the final re-issue was taken the latter were carefully eliminated from the specification.

The rest of this part of Benwick's testimony relates to resemblances of celluloid sets to rubber sets—resemblances which relate wholly to degrees of excellence, and not at all to patentable novelty.

On his cross-examination (Record, p. 59) he testified as follows:

Cross-Q. 27. "In your answer to question 3, you say, 'a "'plate constructed on Cummings' system possesses qualities "'which clearly distinguish it from all the sets of teeth pre-"'ceding it; in the first place it fits better, as the dentist is "'enabled to form the plate upon the original plaster cast "'of the mouth, thus dispensing with the difficult and in-"'accurate process of constructing dies and counter dies, "'stamping the plate up between them; the result is neces-"'sarily an accuracy of fit not to be attained by the old "'method;' do you understand Cummings' patent, reissue "No. 1,904, to comprise this system of forming the plate as a "part of the invention therein described? I mean without "dies or counter dies."

A. "I do not; I use the word system, perhaps inaccurately, "as synonymous with plan, or in other words as if the quota- "tion read—Cummings' plate possesses qualities which, etc.; "if the shape of the plate could be secured in any other way "than that described by Cummings, or by the use of other "devices for shaping it, I should still consider it Cummings' "plate, when it was done."

Here, he is again driven to throw overboard both material and process, rubber, vulcanization and vulcanite, and insists that a plate shaped or moulded in any manner different from that described by Cummings, would still, if it possessed certain useful qualities possessed to some extent *in kind* by all dental plates, be Cummings' plate when it was done. Has Cummings patented the right to make any and every dental plate having certain qualities of general excellence, no matter how or by what material or process those qualities are given to it? The question answers itself. Patents for improvement in an art are not to secure to the patentee a monopoly of practicing the art itself, and a right to suppress the efforts of everyone else to reach the goal which all have the right to attain if they can.

In concluding this part of the argument we recapitulate and reaffirm, that

1. The original Cummings patent was expressly limited in the claim to a product produced by rubber and vulcanization.

2. That the specification of the reissued patent, as if to remove all doubt no that point, thoroughly eliminated every expression which could tend to any other interpretation. It, in effect, disclaimed every material in which rubber was not an essential ingredient, every process in which vulcanization was not an essential step, and every product in which the plate when completed was not vulcanite.

3. The claims of the complainant, put forth through witnesses and counsel, have, on all occasions, uniformly and expressly supported this view of the patent.

4. The decisions have repeatedly settled and confirmed this view.

5. With no other material than rubber can the described product be made by the described process or by any process.

VI.

WHAT ARE EQUIVALENTS OF HARD RUBBER OR VULCANITE PLATES?

The expression in the claim, "or its equivalent," does not enlarge the scope of the invention claimed. The inventor secures himself against the invasion of his rights by the use of known equivalents, whether he, in terms, embraces them in his claim or not (Byam *v.* Farr, 1 Curtis C. C., 263). We submit that there can be no equivalent of hard rubber or vulcanite, or of a "plate of hard rubber or vulcanite," except it be one made out of some vulcanizable compound, which, when vulcanized, is transformed into vulcanite. In other words, the construction of the Cummings patent, by no rule of interpretation known to the law or to good sense, can be extended so as to embrace anything except rubber and its allied gums—gums which, when compounded with some vulcanizing agent, and subjected to heat, transform the compound into a substantially new material, which can be properly called vulcanite.

It is not enough that another and different material can be used to make a set of teeth equally or more useful than those made of vulcanite. This may affect the value of the Cummings patent, but it does not come in legal conflict with it. It does not invade the complainant's rights—it only evades its monopoly. This latter any one has a right to do. In Burr *v.* Duryee, 1 Wall., p. 573, Mr. Justice GRIER, in speaking for the court, says: "But it has been argued that, though not a colorable invasion of the patentee's claim, it is an evasion of his patent, which is equally injurious. If so, it is *damnum absque injuria*. Every man has a right to make an improvement in a machine, and evade a previous patent, provided he does not invade the rights of the patentee."

Something was said in the discussion below on this subject of equivalents. Neither the process of making celluloid sets of teeth, nor the product when made, is an equivalent of that of Commings.

VII.

But if celluloid sets of teeth could be in any sense deemed equivalents of rubber or vulcanite sets, they are not equivalents which this complainant can suppress. Celluloid was not known until after the date of Cumming's invention, nor at the date of his original patent. If it was known at the date of his final re-issue, that does not entitle him to suppress it. A patentee can suppress no equivalent except those which were known to be such at the date of his invention.

Seymour *vs.* Osborn, 11 Wall., 555.
Rees *vs.* Gould, 15 Wall., 193.
Gill *vs.* Wells, 22 Wall., 1.

We are aware, that in these cases, the court, except in one instance, speaks of the *date of the patent* as the point of time prior to which all these known equivalents may be suppressed by the patentee. But in those cases the date of the patent was, for all that appears, coincident with the date of the invention, and no doubt the court treated, for the purpose of this question, the dates as identical. But we respectfully submit, that when there is a difference between the date of the invention and that of the patent, the date of the former should govern. Otherwise, a very singular, and, as we think, absurd result would follow. Two patentees make different inventions in 1860. One promptly takes out his patent. The other neglects to take out his until ten years after. The former, who has at once given his invention to the public under his patent, is limited to equivalents which existed prior to 1860, while the inventor, who has secreted his invention, and neglected for ten years to take out his patent, is enabled to embrace in it all equivalents that have been discovered between 1860 and 1870. This would be encouraging original discoveries in the useful arts with a vengeance! It would

confine the inventor, who deals promptly and fairly with the public, to the rigid limits of his own creations, while it would give to the one whose conduct is characterized by the slackness and procrastination, whereby he withholds all knowledge of his invention from the public for ten years, the fruits, not only of his own ingenuity, but of the ingenuity of other discoverers in the same field, who work while he is secretive and idle. But there is another point applicable to this question in the present case. Has the patentee a right to suppress all equivalents known at the date of his *re-issued* patent? If celluloid was known at the date of this re-issue (upon which we recall no proof), and was not known, as it clearly was not, at the date of the original patent, is the owner of the patent entitled to snppress it? Mr. Renwick in his testimony, on page 54, cautiously remarks: "I state that solid collodion was described before the date of Cumming's *re-issue*, as a substance which might be used in many manufactures where vulcanite had been used." Now, assuming solid collodion to be celluloid, though it is not, would the fact stated by Mr. Renwick entitle the owner of the patent to suppress it as an equivalent of rubber? If so, upon every re-issue of a patent, the patentee would become entitled to cover with his patent, all equivalents which had been invented between the date of his original patent, or of his last preceding re-issue, and the date of his final re-issue.

We respectfully suggest that such a doctrine would lead to an intolerable abuse, and would stimulate the surrender and re-issue of patents for the very purpose of suppressing rival inventions made in the meantime, and which could be termed equivalents.

We submit therefore that the date of the *invention*, where that differs from the patent, should govern the rule as to known equivalents. That is the only safe rule. It was suggested by the other side on the argument below, that this whole doctrine of a distinction between known and unknown equivalents had not been in issue in any decided case. In other words, that the observations of this court thereon are wholly *obiter*. That being the case, it would seem that this court, should this question be reached here, is now free to consider this point as one never yet directly decided. A direct decision upon it is certainly desirable.

VIII.

If we are right in our views of this patent, or, in other words, if the description of this invention put forth by this complainant, and the construction of the patent urged by its counsel, and accepted by the courts for a period of twelve years, are not to be all overturned, and the patent declared to be for any dental plate that is moulded in any manner, and hardened by any means, then we do not infringe. We have already enumerated and explained the steps of the described process by which the described product is produced. His Honor Judge SHEPLEY, had decided that this process, *considered as a whole*, was new—that it inheres in the product, and is a vital characteristic of the latter. This court has affirmed this decision. No process which is not, considered as a whole, the same as that of Cummings, infringes his patent. We not only do not use that process as a whole, but, on the contrary, we discard several of its indispensable steps. On this aspect of the case, the opinion in Mowry *v.* Whitney (14 Wall., 620), is instructive, and, we think, decisive.

The case was this: cast iron car wheels were made, prior to the patentee's invention, by casting the wheel in a mould of which the outer part was iron, while the interior part was of sand. When the molten iron was poured into this mould, it flowed, of course, towards the outer part, and as soon as it came against the iron rim of the mould it "chilled" and "set" with a crystallization at right angles to the inner part of the wheel. This sudden chilling of the molten metal was accompanied by a sudden shrinkage, which crowded up the iron in the sand part of the mould, and which had not yet "set," toward the hub of the wheel. The iron in the sand part of the mould not only cooled more slowly than that which had come against the iron part of the mould, but it assumed a granular crystallization, and as it cooled it also shrank one-eighth of an inch to the foot, so that strains were induced between the two parts, the chilled and the unchilled parts, which resulted invariably in the rupture of the iron either just within the rim or just around the hub. Only spoke wheels were thus made.

To compensate for these antagonistic shrinkages and consequent strains, the hub was divided into sections, so that when the iron shrank, the openings between these sections of

the hub were simply enlarged, and when the wheel had cooled these openings were filled with composition metal and banded with wrought iron, so as to restore the integrity of the wheel.

But with the increasing demand for higher rates of speed on railways, it became essential to make a stronger wheel than could be made of cast iron with spokes and split-hubs banded as described. This demand led to the attempt to cast a solid plate wheel, but the different strains made it impossible to get them of reliable strength. Experiments were made in this behalf, to compensate the strains by giving curves to the web or plate between the chilled rim and the hub, so that the shrinkage would only straighten out the curves more or less, and thus prevent fracture. But none of these forms proved effectual, and as the chilled rim could not be dispensed with except by surrendering the capability of resisting rapid wear upon the tread, the split hub spoke wheel seemed the only reliable form for cast iron railroad wheels.

At this point of difficulty, Whitney realized that no change of form could reconcile the antagonism between the chilled and the unchilled parts of the wheel, and in examining the matter he discovered that the chilled rim would remain unaffected, and retain its hardness unimpaired under a degree of heat which would actually or very nearly fuse the unchilled or granular part of the wheel.

Upon this discovery he based his invention which consisted in a process of prolonging the cooling of the wheel, so that all the parts would shrink alike.

His process consisted:

1st. In removing the wheel from the mould in which it was cast, as soon as it would bear its own weight.

2d. In placing this red hot wheel in a previously heated pit, which arrested the cooling of all parts of the wheel.

3d. In reheating the wheels in the pit, so as to restore to every part about the same temperature which the hottest part of it had when removed from the mould, and

4th. In then retarding the cooling, so that all parts of the reheated wheels would cool and shrink alike.

The court held that the master erred in finding that the entire profits made by defendant were due to the patented invention, inasmuch as it appeared that the defendant could have removed his wheels as Whitney did, fitted them as Whitney did, and slow cooled them as Whitney did, but without reheating them, the patent being for the process as an entirety comprising the four stages specified, and the omission of one of those stages—the reheating—making such a difference that the patent was not infringed—as is the case where a patent is for a combination of elements, and one of the elements is omitted.

IX.

A few additional observations on two cases which have already been referred to in this argument. In the case of the Goodyear Dental Vulcanite Company *v.* Benoni E. Gardner (3 Cliff., 408), Mr. Justice Clifford deals with a question of infringement of the complainant's patent. The passage in his opinion which directly handles that question in the case then before the court is as follows:

"Rubber, such as the complainants use, is compounded "with sulphur, etc., in the manner described in the hard- "rubber patent, but the rubber used by the respondent is "compounded, as he contends, with iodine without sulphur, "and under a different patent. Suppose the fact to be as he "contends, *still it appears that he uses rubber for plates as a sub-* "*stitute for metallic plates*, and that he employs the same "mechanical means in forming the plate and for setting and "adjusting the teeth, and for securing them in position, *and* "*he also employs heat to harden the rubber and fit the product for* "*practical use as a substitute for natural teeth.*"

It will be noticed that the only circumstance in which the defendant Gardner's material or process differed from that of the complainant was in substituting one vulcanizing agent for another. And this was not an essential difference. It did not vary the process, nor change the material so as to vary the part which the latter performed, either in the mechan-

ical means used or in the chemical transformation effected. A vulcanizable compound was used by the defendant; he manipulated it in the same manner as Cummings did, and he then subjected it to heat intense enough and long enough to vulcanize or harden, and thus produced the described product of Cummings by his described process. The mere substitution of one vulcanizing agent for another in the compound was a colorable change. In connection with the rubber, this new vulcanizing agent performed precisely the same function that sulphur did, and resulted in the same product, viz.: "The plate of hard rubber or vulcanite for holding artificial teeth, etc." But to interpret the language of the learned judge as saying that neither rubber or any vulcanizable compound nor vulcanization were essential to constitute infringement, is trifling with and perverting his clearly expressed opinion. We submit that not only in this passage, but in those which describe the Cummings invention and construe his patent, the decision is consistent with and supports our present argument.

The case of the complainants *vs.* Eben M. Flagg, decided by Judge Blatchford in the Southern District of New York, and then discontinued without notice to the defendant, deserves some consideration. The case was presented in elaborate printed briefs, two having been filed on each side. The complainant's counsel claimed that the Dwinelle and Smith records were both on file in the clerk's office in the Circuit Court for that district, and constituted a portion of their motion papers. They distinctly stated in their brief that every matter of fact was then before the court, and that none could be added that could shed any light on the controversy touching the right of the defendant to use celluloid in the manufacture of dental plates or sets of teeth; that the question whether such manufacture was an infringement on the Cummings patent was a pure question of law, and could be as well decided on that motion for a preliminary injunction as at the final hearing of the cause. After full argument, and after duly considering the matter thus presented, his Honor Judge Blatchford rendered the following decision:

"I do not find that any decision has been made in regard "to the plaintiff's patent which gives to it such a construction "as necessarily includes the process and substance used by

" the defendant. In the Gardner case the defendant did not " compound india-rubber with sulphur, but he compounded " india-rubber with iodine, and he employed heat to harden " the rubber." *Goodyear Dental Vulcanite Co.* vs. *Gardner*, 3 *Cliff., p.* 408.

" In the Smith case the view of the court was that the mate- " rial to be used under the plaintiff's patent in carrying out " the invention patented was to be india-rubber and the com- " pounds commonly employed therewith reduced to a soft " plastic condition, capable of vulcanization, and subsequently " vulcanized." *Goodyear Dental Co.* vs. *Smith*, 1 *Holmes R., p.* 354.

" It appears from the description of the process used by the " defendant in this suit that he does not use india-rubber or " any substance capable of vulcanization. That the substance " he uses is one which is rendered plastic by heat, and is not " hardened by heat. That heat is used in the process to " soften the substance and render it plastic, and not to harden " it, and that the substance, after being moulded, is hardened " by being cooled. It is not sufficiently clear that this pro- " cess is embraced in the claim of the plaintiff's patent to " warrant the granting of an injunction until one is awarded " as the result of a decree for the plaintiffs on final hearing." —9*th Patent Office Official Gazette, p.* 153.

We submit that this decision, considering the circumstances under which the case was presented and decided, is deserving of consideration here.

The futile attempt of Mr. Bacon, in his testimony in the present case, to avert its force is hardly worthy of notice. On page 49 of the Record he undertakes to give a new character to vulcanite, in order to show that a set or plate of teeth made from it must be made by the same process as a set made from celluloid; he was asked by his counsel:

" Q. 5. Will you produce a piece of the vulcanizable com- " pound of rubber and sulphur, and state what has to be done " in order to fill the plaster mould within the flask with the " vulcanizable compound, and to make the set of teeth?

" A. I produce such piece of vulcanizable compound.

" This piece of rubber is held in boiling water for a few mo- " ments, when it will become quite soft and plastic; then the " flask, with its plaster contents having been heated about as " hot as it can well be handled, is opened, and the sheet of " plastic material or rubber is placed between the two parts of " the flask; the flask is then closed and placed in a vice, and " pressure gradually applied by screwing up the vice until the

" flask is brought together ; the flask is then placed in an oven " or vulcanizer and heated to about 300 degrees ; after remain- " ing a sufficint time, it is removed and allowed to cool grad- " ually, and harden ; care being taken that the plate should be " perfectly cool before it is taken out of the flask."

The witness has hardly changed the nature of Goodyear's vulcanite, or the process by which it alone can be made.

Both have been well understood for a quarter of a century, and been described by witnesses, counsel and courts repeatedly. To subject the compound to a heat of about 300 degrees (for quite a long time), is, in the language of Mr. Justice CLIFFORD, " to employ heat to *harden the rubber*, and fit it for practical use," or, in the language of Cummings' caveat, " *to bake the teeth into the gums*," or, in the more full and precise language of the Goodyear patent itself, " subjecting the same " (*i. e.*, the compound of rubber and sulphur) " to a high degree " of artificial heat, as in the said vulcanizing process of " Charles Goodyear, until the compound shall have acquired " the required *hard* and tough property found in various de- " grees in *ivory, bone, tortoise, shell and horn*, and the spring- " like property, under flexure, found in whalebone." To this we may add the language of the reissued Cummings's Patent 1,904 : " The soft rubber, etc., * * * is to be subjected to sufficient heat to vulcanize or harden it substantially as directed in that (the Goodyear) patent."

Mr. Renwick (Record, p. 54) touches this subject more gingerly. He did not care to vulcanize his own fingers with it. In answer to question 5, he says :

" Q. 5. Do you understand that celluloid is compounded " with sulphur, rubber, etc., in the way sulphur and rubber are " usually compounded, or is subjected to heat to harden it ?

" A. I do not understand that celluloid is compounded with " sulphur, or has any sulphur in it ; I understand that celluloid " is subjected to heat while in moulds, to soften it, and make it " fit the teeth perfectly by pressure, as the vulcanizable com- " pound is, and that celluloid is hard when cold, hardening " during the cooling. A vulcanizable compound becomes of a " tarry consistency when subjected to heat in the mould, *and* " *is hard when cold, after* being subjected to the heat, but I do " not know when it commences to harden, whether during the " cooling or while at the highest heat ; although I do know " that the final hardening takes place during the cooling."

Both this and Mr. Bacon's testimony on this point are puerile and shuffling. If they mean anything more than that the compound of rubber and sulphur *after* it has been subjected for a considerable time to a high degree of heat, and thereby changed into vulcanite, may grow somewhat harder while cooling, their statements are in conflict with the notorious facts of which the court will take judicial notice.

But a sufficient answer to the whole matter, so far as it has any importance in the present controversy, is, that neither vulcanite, nor "the plate of hard rubber or vulcanite" claimed in Cummings' patent, can be made without vulcanization; and vulcanization takes place while the material is being subjected to the action of the heat.

We submit, that in no aspect of this case do we infringe any right secured to the complainants under the Cummings' patent, and that the judgment below should be affirmed.

WM. D. SHIPMAN,
Of Counsel for Appellee